LOS VAQUEROS

A Water Quality and Resource Management Project
Sponsored by
Contra Costa Water District

Draft Stage 2 Environmental Impact Report/ Environmental Impact Statement for the Los Vaqueros Project SCH #91063072

Lead Agencies:

Contra Costa Water District
Concord, California

U.S. Department of the Interior
Bureau of Reclamation, Mid-Pacific Region
Sacramento, California

Technical Assistance Provided by:

Jones & Stokes Associates, Inc.
James M. Montgomery, Consulting Engineers, Inc.
Woodward-Clyde Consultants
Sonoma State University

February 1992

Draft

STAGE 2 ENVIRONMENTAL IMPACT REPORT/ ENVIRONMENTAL IMPACT STATEMENT FOR THE LOS VAQUEROS PROJECT CONTRA COSTA COUNTY, CALIFORNIA

Lead Agencies:

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Cooperating Agencies:

U.S. Army Corps of Engineers

Technical Assistance Provided by:

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This environmental impact report/environmental impact statement (EIR/EIS) is prepared in compliance with the California Environmental Quality Act, the National Environmental Policy Act, and Contra Costa Water District (CCWD) and U.S. Bureau of Reclamation (Reclamation) procedures.

CCWD is proposing to improve the quality of water supplied to its customers, to minimize seasonal quality changes, and to improve the reliability of its water supply by providing emergency storage.

Reclamation proposes to amend article 4 of its water service contract with the CCWD to add a point of intake in the Delta on Old River in addition to Rock Slough. In addition, several Reclamation water rights would be modified to add points of diversion and rediversion at upstream storage sites that would allow water to be delivered for the Los Vaqueros Project under CCWD's water service contract with Reclamation for 195,000 acre-feet per year (af/yr). Reclamation currently delivers about 130,000 af/yr. Action taken by Reclamation would allow CCWD to construct and operate the Los Vaqueros Project and regulate the water supply distributed by the existing system.

The U.S. Army Corp of Engineers is considering issuing Department of Army permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. This EIR/EIS is not intended to fully comply with the Section 404(b)(1) guidelines; a separate alternatives analysis is being prepared to comply with these guidelines.

This EIR/EIS analyzes the impacts of the proposed project and alternatives. The impact areas evaluated include water resources and quality; fisheries; vegetation and wildlife; recreation; visual resources; geology, seismicity, and soils; cultural resources; land use; public health and safety; transportation; air quality; noise; energy; population, employment, and housing; public services; fiscal effects; customer impacts; and growth-inducing and cumulative effects. This EIR/EIS also fulfills the requirements of Executive Orders 11988 (floodplain management) and 1990 (protection of wetlands).

For further information regarding this EIR/EIS, contact: Mr. Gary Darling or Ms. Janice Hutton, Contra Costa Water District, P.O. Box 4121, Concord, California, 94524, 510/674-8130; or Mr. Doug Kleinsmith, U.S. Bureau of Reclamation, Mid-Pacific Division, MP-750, 2800 Cottage Way, Sacramento, California, 95825, 916/978-5121.

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Summary

BACKGROUND

Contra Costa Water District (CCWD) is proposing the Los Vaqueros Project to improve the quality of water supplied to CCWD customers, minimize seasonal quality changes, and improve the reliability of its water supply. CCWD provides its customers with water through a contract with the U.S. Bureau of Reclamation (Reclamation), which administers the Central Valley Project. This water supply is subject to substantial variations in quality, however, during seasonal periods of saltwater intrusion from San Francisco Bay into the Sacramento-San Joaquin Delta, CCWD's water source.

The seasonal changes in quality are noticeable to those who drink the water and to those who use the water for commercial, industrial, and agricultural uses. The typical annual deterioration in water quality as Delta salinities increase is objectionable to many CCWD customers and costly to all residential and industrial users. In addition, the CCWD system depends on nearly continuous operation of all four of its pumping facilities along the Contra Costa Canal. If these facilities were shut down because of a chemical spill in the Delta, drought, severe earthquake, other Delta water quality problems, or damage to facilities, CCWD could meet unconstrained peak water demands for only about 3-7 days by drawing from its small reservoirs (Contra Loma, Martinez, and Mallard), which provide a combined usable storage of about 5,000 acre-feet (af).

CCWD generally evaluated alternatives for meeting its basic project purposes in the Stage 1 environmental impact report (EIR) for the Los Vaqueros/Kellogg Project (Jones & Stokes Associates 1986). The relatively broad based Stage 1 EIR narrowed the range of options to reservoir concepts within the Kellogg Creek watershed as the only type of alternative that could meet CCWD's basic project purposes.

Since the Stage 1 EIR was certified, detailed engineering and environmental studies have been undertaken not only to better define a specific project, but to determine CCWD's specific needs, objectives, and constraints. The detailed information that has been gathered since 1986 necessitates a reevaluation of the reservoir project concept and all other potential alternatives for meeting CCWD's basic project purpose. Regulatory requirements also dictate that a full range of alternatives be evaluated so that CCWD can meet its basic project purpose in the least environmentally damaging practicable manner.

CCWD also prepared and certified a separate EIR in 1990 to assess the effects of relocating Vasco Road and several utility facilities that could be affected by implementing the Los Vaqueros Project. This EIR was prepared as a separate EIR because of the need to relocate these facilities before construction of a reservoir in the Kellogg Creek watershed could begin and because substantial local public and agency involvement was required to develop an acceptable approach for relocating Vasco Road and the utility facilities.

Because Reclamation would need to approve amendments to its water supply contract with CCWD and modifications to certain of its facilities to allow the Los Vaqueros Project to operate, an environmental impact statement (EIS) must be prepared. Therefore, this joint Stage 2 EIR/EIS for the Los Vaqueros Project has been prepared.

PROJECT PURPOSE AND NEED

CCWD's specific primary goals and objectives are:

- to improve the quality of water supplied to CCWD customers and minimize seasonal quality changes by providing consumers with water quality at the tap of 65 milligrams per liter (mg/l) chloride and 50 mg/l sodium 100% of the time, to supply CCWD customers with the highest quality water practical, and to provide all reasonable protection of the supply from any known source of contamination hazard;

- to improve the reliability of the CCWD supply by providing for emergency storage to supply 75% of the maximum projected 3-month demand in 2025 (56,000 af), with the provision that up to 26,000 af of this emergency storage can be used to enhance water quality during dry and critical years; and

- to meet these water quality and reliability objectives by developing and constructing a project by 1995 with an estimated cost to CCWD in 1988 dollars of $350 million and by minimizing costs (CCWD Resolution No. 88-45).

PUBLIC AND AGENCY INVOLVEMENT

Since completion of the Stage 1 EIR, CCWD has continually given updates on its progress to individuals, agencies, and groups that have expressed interest in or have jurisdiction over some aspect of the project. These coordination activities have continued throughout preparation of the Stage 2 EIR/EIS.

CCWD and Reclamation have entered into a memorandum of understanding that clarifies the roles of each agency in the environmental review process and the process to obtain water rights from the California State Water Resources Control Board.

Scoping

CCWD and Reclamation published a notice of preparation/notice of intent on March 1, 1990, to inform agencies and the general public that this Stage 2 EIR/EIS was being prepared and to invite specific comments on the scope and content of the document.

CCWD and Reclamation held three scoping meetings to solicit public comments to help determine the scope and content of this Stage 2 EIR/EIS. Scoping meetings were held in Livermore, Concord, and Antioch on April 12, 17, and 19, 1990, respectively.

APPROACH TO ALTERNATIVES DEVELOPMENT

Both EIRs and EISs are required to describe and evaluate reasonable alternatives to a proposed action, and both must describe a no-action alternative that assumes that the proposed action and alternatives are not implemented. In addition, to meet its basic project purpose, CCWD may need to discharge dredged or fill materials into waters of the United States. Section 404 of the Clean Water Act provides the statutory mechanism to regulate such discharges, and the Section 404(b)(1) guidelines govern, in part, the issuance of permits. In compliance with the guidelines, CCWD has prepared an alternatives

analysis to determine if practicable alternatives exist that do not involve the discharge of dredged or fill materials into waters of the United States.

CCWD has used the Section 404(b)(1) alternatives analysis process to determine which of the possible alternatives for meeting its water quality and reliability objectives are appropriate for analysis in this Stage 2 EIR/EIS. A three-stage screening process is being conducted as part of the alternatives analysis. The alternatives analysis considered over 120 possible alternatives. The first two stages of screening have been completed. The Stage 2 EIR/EIS is an integral part of the third stage of screening.

ALTERNATIVES CONSIDERED IN DETAIL IN THIS EIR/EIS

CCWD has undertaken considerable work in formulating the alternatives evaluated in this EIR/EIS. Cost and engineering factors, water quality and reliability objectives, the Section 404 permit process, institutional considerations, and numerous environmental factors have had substantial influence in shaping the alternatives briefly described below.

No-Action Alternative

The No-Action Alternative assesses future conditions within the Delta and CCWD service area as they are projected to be in approximately 2025, at buildout of the CCWD system, when CCWD is making full use of its contract with Reclamation with no Los Vaqueros Project.

Addressing this scenario allows a complete comparison of the impacts of a CCWD project at the time CCWD is making full use of its contracted water supply.

Los Vaqueros Reservoir Alternative

Background

The Los Vaqueros Reservoir Alternative would consist of a 100,000-af reservoir within the Kellogg Creek watershed (Figure S-1) and associated appurtenant facilities, including a new supplemental Delta intake location, conveyance pipelines, transfer reservoir, pumping plants, and other facilities necessary for project operation. Water diverted from the new Delta intake location would be pumped to the Los Vaqueros Reservoir site during periods when Delta water quality is good (winter and spring months in most years). In late summer, when Delta water quality deteriorates, reservoir water would be released and blended with Delta water from direct diversions to reduce salinity. This water would be delivered to the existing Contra Costa Canal system to be blended with water in the canal diverted from Rock Slough for use within CCWD's service area.

CCWD has addressed several configurations of the Los Vaqueros Reservoir Alternative in this Stage 2 EIR/EIS. These configurations share many common facilities that can be generally described. Each of the Los Vaqueros Reservoir Alternative configurations would include the following facilities and activities:

- a new supplemental intake location in the Delta, approximately 5-10 miles from the Los Vaqueros Reservoir site with a new electric transmission line to supply power, and new pipelines to convey water from the new intake location to the Los Vaqueros Reservoir;
- a 100,000-af reservoir at the Los Vaqueros Reservoir site;

- relocation of several utility facilities within the Kellogg Creek watershed and relocation of Vasco Road to a route adjacent to the watershed (see Vasco Road and Utility Relocation Project EIR);
- a 3-million-gallon (approximately 10-af) transfer reservoir and pumping plant with an electric transmission line supplying power to divert the required flows from the Delta to either the Los Vaqueros Reservoir through the transfer pipeline (see below) or to the Contra Costa Canal through the Los Vaqueros pipeline (see below); and
- a 96-inch-diameter Los Vaqueros pipeline to deliver up to 200 cubic feet per second (cfs) of water from the transfer pumping plant to the Los Vaqueros Reservoir and to return up to 400 cfs from the Los Vaqueros Reservoir to the Contra Costa Canal.

Rock Slough/Old River Configurations

These six alternate configurations would involve construction of a new 250-cfs intake and fish screen facility at one of five potential locations along Old River between the Mokelumne Aqueduct crossing and Clifton Court Forebay (two configurations share an intake site) (Figure S-1). Projected diversions from each of these locations would be identical, as would the reservoir location and size. The primary differences among the six configurations under consideration are the locations of the new intake, the associated conveyance pipelines, and the transfer reservoir.

Rock Slough/Old River configurations No. 3 and 4 have a higher capital cost than the other configurations in part because of the greater length of associated pipelines to convey water from the intake location to the transfer reservoir site and the Los Vaqueros Reservoir. These configurations are being considered by CCWD because the California Department of Water Resources (DWR) is considering expanding Clifton Court Forebay along Old River south of Indian Slough. This expansion could affect the quality of water at the other Old River intake locations under consideration.

Rock Slough/Clifton Court Forebay Configuration

This alternate configuration would be essentially identical to the Rock Slough/Old River configuration described above except that the intake location for the project would be located on Clifton Court Forebay (Figure S-1), a facility owned and operated by DWR as part of the State Water Project. The new 250-cfs intake and fish screen facility would be located upstream of the State Water Project's Skinner Fish Facility.

Kellogg Reservoir Alternative

This reservoir alternative would operate much like the Los Vaqueros Reservoir Alternative described above except that the reservoir would be located at the Kellogg Reservoir site instead of the Los Vaqueros Reservoir site (Figure S-1). Water would be supplied to the reservoir from the Old River No. 5 intake location.

Desalination/EBMUD Emergency Supply Alternative

This alternative would involve the construction of a desalination plant near the Contra Costa Canal, together with an electric transmission line. No reservoir would be constructed. This alternative would involve the continued direct diversion of water from the Delta through the existing Rock Slough intake. The plant would involve the use of a membrane process, such as reverse osmosis, to achieve the water quality goals of CCWD (Figure S-2). In addition, the facilities of this alternative would be combined with an intertie

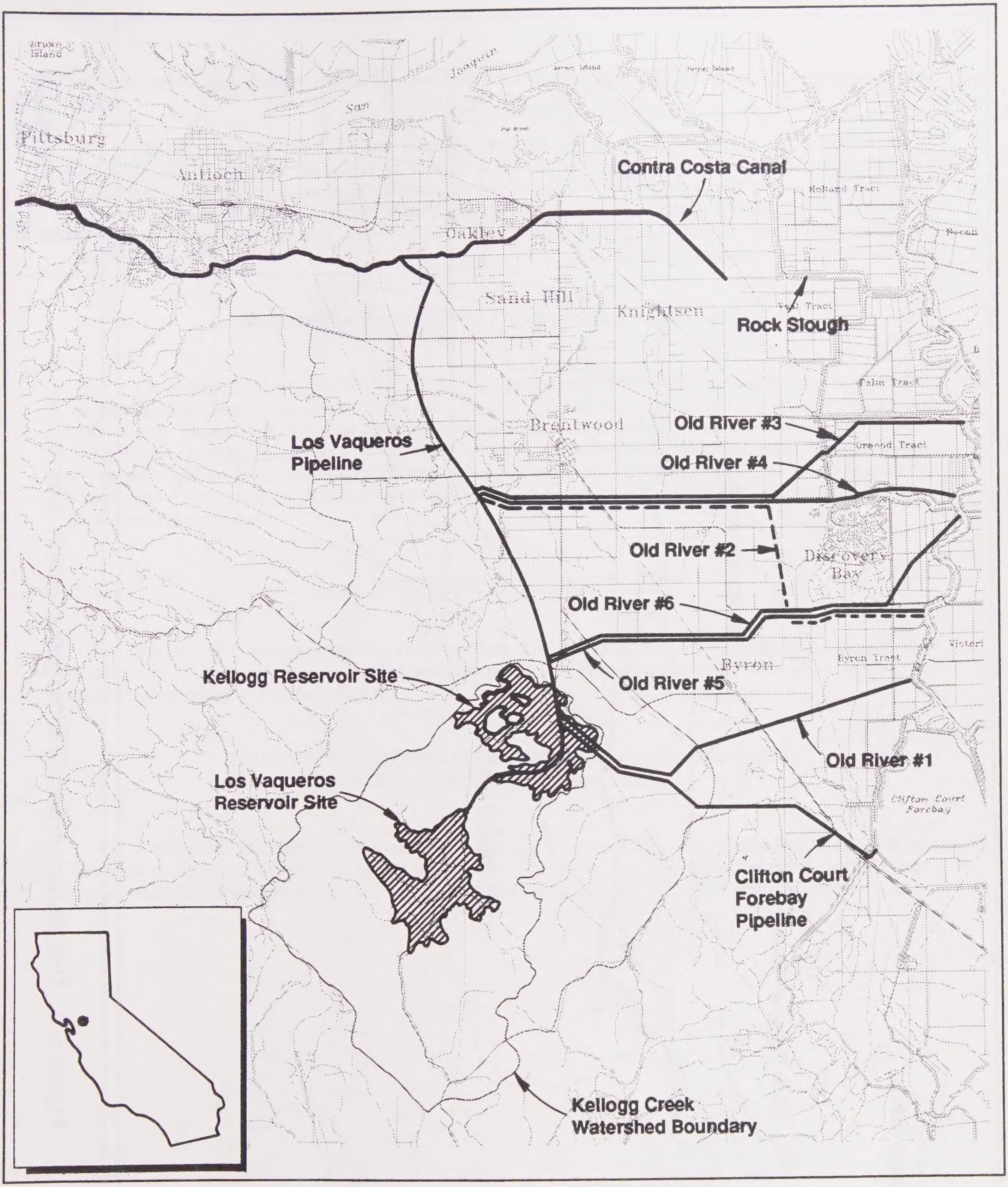

Figure S-1. Los Vaqueros Reservoir and Kellogg Reservoir Project Alternatives

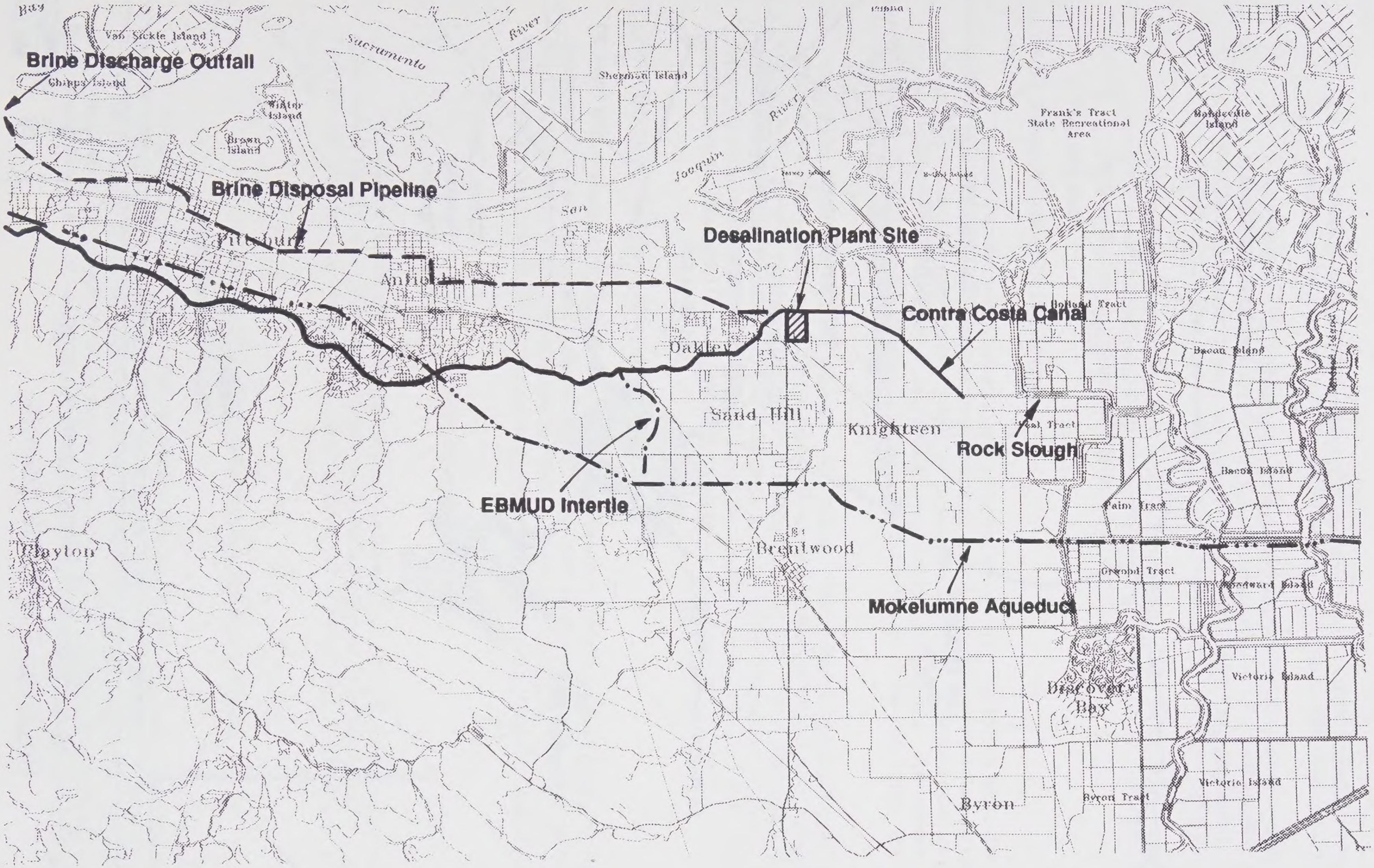

Figure S-2. Desalination/EBMUD Emergency Supply Alternative

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with East Bay Municipal Utility District's system to meet a small portion of CCWD's emergency water supply needs.

Desalination processes produce a waste stream of very poor quality water that requires disposal. To enable CCWD to make full use of its 195,000-af/yr contract with Reclamation, diversions from Rock Slough would need to be increased above No-Action Alternative levels because most processes suitable for use by CCWD involve rejecting approximately 20% of the water passed through the plant. This alternative also would involve construction of a pipeline to discharge brine reject to Suisun Bay, where discharge requirements could be met.

Middle River Intake/EBMUD Emergency Supply Alternative

Under this alternative, CCWD would construct only a new supplemental intake facility, together with an electric transmission line, along Middle River (Figure S-3) and a pipeline to convey water to the Contra Costa Canal. No reservoir would be constructed under this alternative. This pipeline facility would be similar to the pipeline facilities described above under "Los Vaqueros Reservoir Alternative", although it would follow a different alignment. This alternative would also include an intertie with East Bay Municipal Utility Distict's Mokelumne Aqueduct at the Middle River intake site. The intertie would supply only a portion of CCWD's emergency supply needs.

PREFERRED ALTERNATIVE

Based on a thorough analysis and comparison of all environmental, engineering, performance, and cost criteria, CCWD and Reclamation have selected the Los Vaqueros Reservoir Alternative with a new supplemental intake at Old River No. 5 site.

SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS AND AVAILABLE MITIGATION MEASURES

Table S-1 summarizes the significant environmental impacts of the Los Vaqueros Project alternatives. The table is organized to present impacts by environmental topic area, indicating the significance of each impact, available mitigation measures, and the significance of each impact if mitigation is implemented.

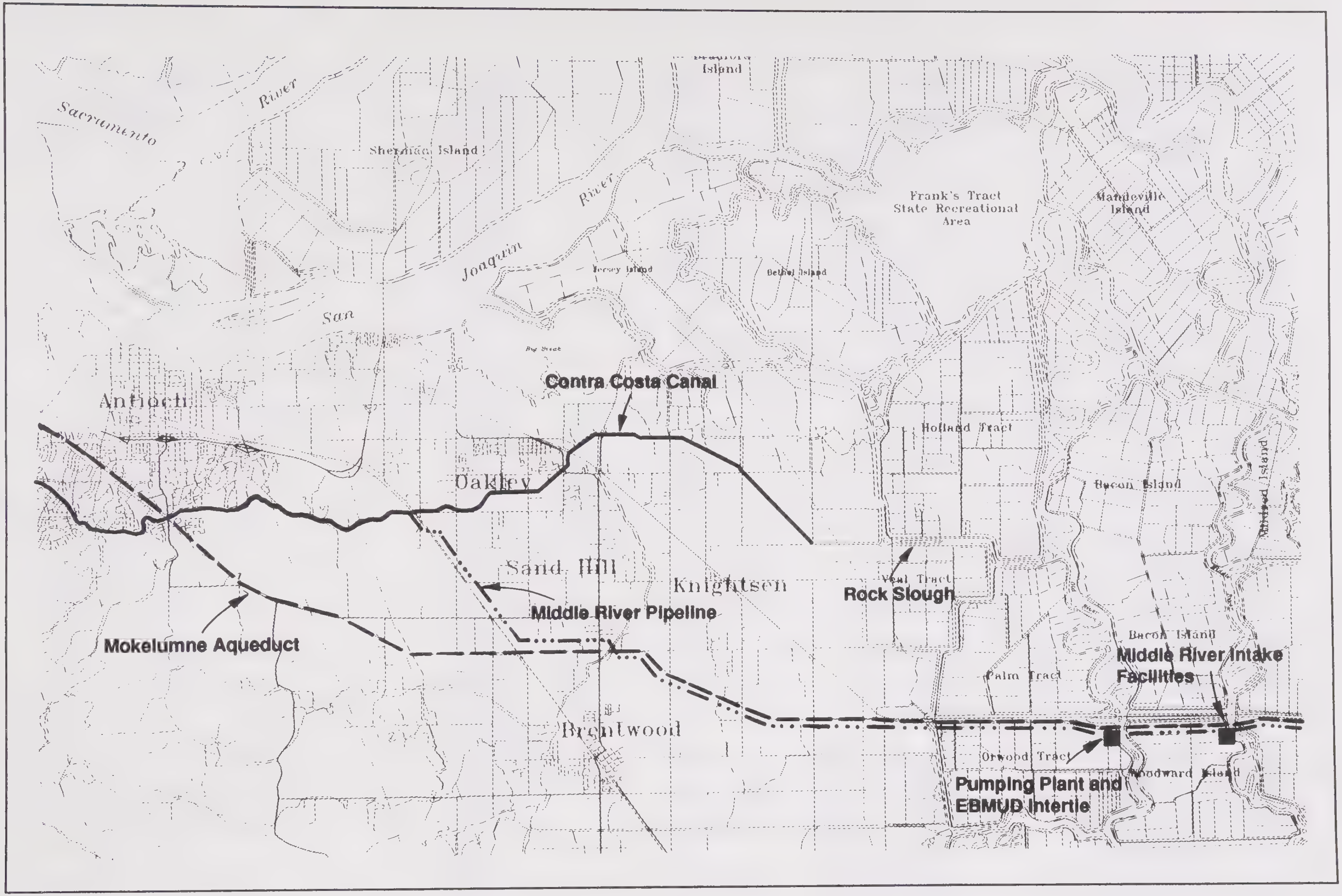

Figure S-3. Middle River Intake/EBMUD Emergency Supply Alternative

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Table S-1. Summary of Significant Impacts and Mitigation Measures for Los Vaqueros Reservoir and Alternatives

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
DELTA SYSTEM HYDRODYNAMICS			
All alternatives	No significant impacts were identified		
DELTA SYSTEM FISHERY RESOURCES			
No Action		In the future, appropriate agencies could jointly participate in funding the following improvements, which would reduce impacts of the No-Action Alternative to less-than-significant levels	
	1. Increased diversion and mortality of outmigrant chinook salmon into the central Delta through the Delta Cross Channel	Construct a gate on Georgiana Slough, or construct a new Delta Cross Channel connection and provide fish screens	LS
	2. Decreased survival of chinook salmon, Delta smelt, and striped bass larvae in the central Delta	Increase San Joaquin River inflow and reducing diversions to minimize impacts on outmigrating juvenile chinook salmon in the San Joaquin River, and on striped bass and Delta smelt	LS
	3. Increased entrainment of all runs of chinook salmon (including winter run), striped bass, and Delta smelt at the CVP and SWP Delta export locations	Implementing the mitigation measure described for impact 1 above would eliminate entrainment impacts on chinook salmon in the Sacramento River, and on striped bass and Delta smelt; closing Old River at its confluence with the San Joaquin River near Mossdale during March-June would reduce impacts on chinook salmon in the San Joaquin River	LS
	4. Increased temperatures in the Sacramento River would reduce survival of all runs of chinook salmon (including winter run)	Install the Shasta temperature control device and maintain adequate cold-water storage in Shasta Reservoir	LS
	5. Increased temperatures in the American River would reduce spawning success of chinook salmon	Develop minimum storage requirements to provide sufficient cold-water storage to maintain suitable American River water temperatures	LS
	6. Lower average storage levels in Folsom Reservoir would reduce reservoir fish productivity	Operate Folsom Reservoir to maintain stable water levels through the spawning and rearing period and enhance reservoir fishery habitat	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
Los Vaqueros Reservoir and Kellogg Reservoir	7. Construction of intake facilities could increase suspended sediments in Delta waterways, possibly reducing spawning and rearing habitat quality	CCWD should employ measures such as floating silt curtains, silt fences, and stormwater detention to reduce siltation	LS
	8. Construction of the intake facilities could eliminate fish habitat at the sites	CCWD should restore fishery habitat at the selected intake facility site	LS
	9. Los Vaqueros and Kellogg Reservoirs would provide additional habitat for warm-water fish species	None required	B
	10. Slight contribution to significant cumulative impacts identified under the No-Action Alternative (see impacts 1-6 above)	CCWD should contribute to ongoing fishery mitigation programs, such as those developed under the Two-Agency Fish Agreement	LS
Desalination/EBMUD Emergency Supply	See impacts and mitigation measures 7, 8, and 10 above		
Middle River Intake/EBMUD Emergency Supply	See impacts and mitigation measures 7, 8, and 10 above		
DELTA SYSTEM WATER QUALITY			
No Action	1. Increased salinity at western Delta stations, especially during dry periods	Appropriate agencies should comply with future Delta water quality standards	LS
Los Vaqueros Reservoir and Kellogg Reservoir	2. Potential short-term degradation of surface water quality at various sites during construction	CCWD should implement soil erosion and pollutant control measures	LS
	3. Increased salinity at Rock Slough because of decreased dilution of agricultural drainage	Appropriate regulatory agencies should enforce water quality control laws and regulations for agricultural drainage	LS
Desalination/EBMUD Emergency Supply	See impact and mitigation measure 2 above		
	4. Discharge of saline brine into Suisun Bay could contain higher levels of some water quality constituents than allowed under the basin plan	CCWD should conduct modeling studies and implement appropriate treatment requirements	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
Middle River Intake/EBMUD Emergency Supply	See impact and mitigation measure 2 above		
KELLOGG CREEK WATER RESOURCES AND PUBLIC SAFETY			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir and Kellogg Reservoir	1. Decrease in Kellogg Creek floodplain area caused by the storage of floodflows in the reservoir	None required	B
	2. Potential for degradation in quality of water stored in reservoir because of algae growth and temperature stratification	CCWD should conduct studies and design reservoir outlet structure to allow operational flexibility to manage water quality	LS
Desalination/EBMUD Emergency Supply	No significant impacts were identified		
Middle River Intake/EBMUD Emergency Supply	No significant impacts were identified		
VEGETATION RESOURCES			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir			
All configurations	1. Potential for impacts on vegetation resources in small unsurveyed portions of project area	CCWD should conduct site-specific surveys and wetland delineations on approximately 20 unsurveyed acres and mitigate any potential impacts as described below	LS
	2. Potential incidental construction impacts	CCWD should mitigate any incidental impacts as described below	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	3. Potential impacts from reservoir operation, watershed management, and recreation uses	CCWD should develop a final recreation plan and incorporate into a long-term watershed management plan appropriate fuel and fire management guidelines to protect special-status plant species and significant natural communities; if additional impacts occur, CCWD should mitigate them as described below	LS
	4. Potential hydrological modification of wetlands	CCWD should employ best management practices to minimize erosion upslope of wetlands; CCWD should avoid wetland areas when designating access roads, staging areas, and temporary spoil stockpile sites	LS
	5. Loss of 180 acres of valley oak woodlands	CCWD should compensate for unavoidable valley oak woodland losses by creating new valley oak woodlands close to the affected area; the intent should be to fully recover lost values within 75 years	LS
	6. Potential secondary impacts on wetlands along the relocated Vasco Road alignment	Contra Costa County should enforce its policies regarding subdivision of agricultural lands and protection of wetlands	LS
Rock Slough/Old River No. 1 configuration	7. Loss of 23.6 acres of seasonal alkali wetlands	CCWD should avoid and minimize loss of seasonal alkali wetlands; where avoidance is infeasible, CCWD should compensate for any losses by creating sufficient out-of-kind/like-value wetland areas to ensure no net loss of acreage, values, and functions	LS
	8. Loss of 12.4 acres of alkali marsh/seep	CCWD should avoid and minimize these losses where feasible; where avoidance is infeasible, CCWD should recreate sufficient alkali marsh areas to ensure no net loss of acreage, values, and functions	LS
	9. Loss of 0.6 acre of northern claypan vernal pool	CCWD should avoid and minimize these losses where feasible; where avoidance is infeasible, CCWD should recreate sufficient northern claypan vernal pool areas to ensure no net loss of acreage, values, and functions	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	10. Loss of 3.3 acres of willow-cottonwood riparian woodlands	CCWD should avoid and minimize these losses where feasible; where avoidance is infeasible, CCWD should recreate sufficient willow-cottonwood riparian woodland areas to ensure no net loss of acreage, values, and functions	LS
	11. Elimination or fragmentation of four populations of brittlescale consisting of 400 plants and two populations of San Joaquin spearscale consisting of 1,500 plants	CCWD should establish new, self-sustaining populations or enhance existing populations	LS
Rock Slough/Old River No. 2 configuration	12. Loss of 18.9 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	13. Loss of 12.2 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	14. Loss of less than 0.1 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	15. Loss of 3.3 acre of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
	16. Elimination of one population of San Joaquin spearscale consisting of 1,500 plants	See mitigation measure for impact 11 above	LS
Rock Slough/Old River No. 3 configuration	17. Loss of 4.7 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	18. Loss of 12.1 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	19. Loss of less than 0.1 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	20. Loss of 3.3 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
Rock Slough/Old River No. 4 configuration	21. Loss of 7.3 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	22. Loss of 15.6 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	23. Loss of less than 0.1 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	24. Loss of 6.1 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
Rock Slough/Old River No. 5 configuration	25. Loss of 3.9 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	26. Loss of 11.7 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	27. Loss of less than 0.1 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	28. Loss of 3.3 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
Rock Slough/Old River No. 6 configuration	29. Loss of 3.9 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	30. Loss of 12.2 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	31. Loss of less than 0.1 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	32. Loss of 3.3 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
Rock Slough/Clifton Court Forebay configuration	33. Loss of 22.4 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	34. Loss of 12.4 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	35. Loss of 0.8 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	36. Loss of 3.3 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
Kellogg Reservoir	See impacts and mitigation measures 1-4 above		LS
	37. Loss of 5.2 acres of valley oak woodlands	See mitigation measure for impact 5 above	LS
	38. Loss of 124.1 acres of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	39. Loss of 8.2 acres of alkali marsh/seep	See mitigation measure for impact 8 above	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	40. Loss of 0.01 acre of northern claypan vernal pool	See mitigation measure for impact 9 above	LS
	41. Loss of 3.1 acres of willow-cottonwood riparian woodlands	See mitigation measure for impact 10 above	LS
	42. Elimination or fragmentation of three populations of San Joaquin spearscale consisting of 86,194 plants, three populations of brittlescale consisting of 1,500 plants, and two populations of stinkbells consisting of 1,750 plants	See mitigation measure for impact 11 above	LS
Desalination/EBMUD Emergency Supply	43. Loss of 6.7 acres of brackish marsh	CCWD should avoid and minimize losses of brackish marsh; if avoidance is infeasible, CCWD should compensate for losses by restoring degraded occurrences	LS
Middle River Intake/EBMUD Emergency Supply	44. Loss of 0.5 acre of seasonal alkali wetlands	See mitigation measure for impact 7 above	LS
	45. Loss of 0.3 acre of alkali marsh/seep	See mitigation measure for impact 8 above	LS
	46. Loss of 0.1 acre of mixed riparian woodlands	See mitigation measure for impact 10 above	LS
WILDLIFE RESOURCES			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir			
All configurations	1. Potential for impacts in small unsurveyed portions of the project areas	CCWD should conduct site-specific surveys for small areas not yet surveyed and mitigate any potential impacts as described below	LS
	2. Potential for impacts on San Joaquin kit fox during construction	CCWD should conduct preconstruction surveys and undertake appropriate precautions using established protocol	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	3. Loss of 404 acres of known occupied San Joaquin kit fox habitat because of reservoir construction and construction of the County Line Alignment (Modified), and loss of 414 acres of habitat because of reservoir construction, road construction, and construction of the Kellogg transfer reservoir (Rock Slough/ Old River No. 1 and Rock Slough/Clifton Court Forebay configurations only); increased potential for road mortalities along the County Line Alignment (Modified)	CCWD acquisition and management of the Kellogg Creek watershed would provide substantially greater acreage than required to achieve typical 3:1 mitigation ratios; CCWD may also consider acquiring lands adjacent to the Kellogg Creek watershed near a previously used natal den site; CCWD will also provide appropriate fencing and undercrossings along the County Line Alignment (Modified) to reduce the potential for road mortalities	LS
	4. Loss of substantial portions of habitat for California tiger salamanders, California red-legged frogs, and western pond turtles in Kellogg Creek because of reservoir construction, in Brushy Creek because of the County Line Alignment (Modified), and along the water conveyance pipeline alignments	CCWD should avoid or replace affected California tiger salamander habitat; specific measures may include replacing affected breeding ponds and providing specially designed fencing and undercrossings; California red-legged frogs and western pond turtles should be relocated from affected areas	LS
	5. Potential disruption to nesting golden eagles during construction	CCWD should survey potential nest sites before construction and should, if nests are being successfully used, establish physical or temporal buffers around the nests during construction	LS
	6. Potential disruptions to breeding burrowing owl populations during construction of the County Line Alignment (Modified) and some water conveyance pipeline alignments	CCWD should conduct preconstruction surveys of suitable habitat and establish physical or temporal buffers around active nest sites	LS
	7. Potential for hydrologic modification of Brushy Creek because of construction of the County Line Alignment (Modified)	CCWD should undertake actions to prevent such modification, including, but not limited to, restricting construction of stream crossings to low-flow periods, limiting use of local surface water, covering exposed soil, and constructing culverts to minimize hydrologic changes	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	8. Potential impacts on fairy shrimp in rock outcrop intermittent pools during construction and because of recreation uses	CCWD should avoid rock outcrop intermittent pools during construction and should ensure that these pools are unaffected by recreation uses	LS
Kellogg Reservoir	See impacts and mitigation measures 1, 2, and 4-8 above		
	9. Loss of approximately 1,100 acres of occupied San Joaquin kit fox habitat because of reservoir and road construction	See mitigation measure for impact 3 above	LS
Desalination/EBMUD Emergency Supply	10. Potential impacts on two special-status wildlife species (salt marsh yellowthroat and Suisun song sparrow), and three species listed under the California or federal Endangered Species Acts (California black rail, California least tern, and salt marsh harvest mouse) because of construction of the brine disposal pipeline in brackish marsh	CCWD should conduct intensive surveys to determine whether these species are present and, if so, reroute the alignment to avoid impacts	LS
Middle River Intake/EBMUD Emergency Supply	11. Potential impacts on the California black rail at the Middle River intake facility site	CCWD should conduct preconstruction surveys and avoid midriver wetlands; if California black rails are breeding near the intake facility site, construction activities during the breeding season (March-July) should be postponed until after the breeding season	LS
VISUAL RESOURCES			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir			
All configurations	1. Creation of unvegetated exposed ring around reservoir when drawn down, particularly during drier years	No mitigation is available	S
	2. Strong contrast of dam and spillway with surrounding viewshed	CCWD should screen dam and spillway edges with native vegetation	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	3. Alteration of prominent ridge near dam site excavated to obtain construction materials	CCWD should implement detailed quarry reclamation plan, including locating quarry to minimize visibility, minimizing removal of vegetation, preventing erosion, recontouring and revegetating the area, and monitoring revegetation success	LS
	4. High visibility of intake facility from scenic waterway (Old River) and various roadways	CCWD should visually screen intake facilities from sensitive receptors by using vegetation, earth berms, and aesthetically sensitive design	LS
	5. High visibility of electric transmission line at intake facility site	No mitigation is available	S
Rock Slough/Old River No. 1 and Rock Slough/Clifton Court Forebay configurations	6. High visibility of transfer reservoir site to Kellogg Creek watershed recreation users	CCWD should visually screen the Kellogg transfer reservoir facility from sensitive receptors by using vegetation, earth berms, and aesthetically sensitive design	LS
Kellogg Reservoir	See impacts and mitigation measures 1, 2, 4, and 5 above.		
	7. Additional visual impacts from creation of six saddle dams	CCWD should screen edges of dams with native vegetation	LS
Desalination/EBMUD Emergency Supply	8. High visibility of the desalination plant from surrounding locations	CCWD should visually screen the desalination plant from sensitive receptors by using vegetation, earth berms, and aesthetically sensitive design	LS
Middle River Intake/EBMUD Emergency Supply	See impacts and mitigation measures 4 and 5 above		
GEOLOGY, SEISMICITY, AND SOILS			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir and Kellogg Reservoir	1. Low to moderate potential for reservoir-induced seismic activity, which would likely not be noticeable and would not be of greater magnitude than the maximum credible earthquake for the affected fault	Although no measures are available to reduce this impact to a less-than-significant level, CCWD should monitor seismicity and implement a reservoir operations management plan if increased seismic activity is noted	S

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	2. Potential for soil erosion, sedimentation, and landslides at perimeter of reservoir	CCWD should implement a comprehensive erosion control and restoration plan to control short-term and long-term erosion	LS
	3. Loss of 10-22 acres (depending on configuration) of soils classified as prime, unique, or of statewide importance	No mitigation is available	S
	4. Mixing of soil horizons during pipeline construction and the resulting potential loss of productivity of soils designated as prime, unique, or of statewide importance	CCWD should implement construction methods for reducing soil impacts, including stripping and storing topsoils separately, avoiding compacting soils outside of pipeline right-of-way, and avoiding operation of heavy equipment in periods of high precipitation	LS
Desalination/EBMUD Emergency Supply	See impact and mitigation measure 4 above		
Middle River Intake/EBMUD Emergency Supply	See impact and mitigation measure 4 above		
CULTURAL RESOURCES			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir	1. Potential impacts on between 54 and 76 cultural resource sites (depending on the alternate configuration) that may be eligible for the National Register of Historic Places (NRHP)	CCWD should implement the following measures as appropriate for each site: avoid sites, prevent ground-disturbing activities near sites, prevent access to historic properties, assess the area of potential effect for sensitivity of buried resources and monitor areas during construction, design project facilities to be unobtrusive, consult with Native American groups, evaluate sites and conduct data recovery for NRHP-eligible properties, design reuse of historic properties to preserve important characteristics, and prepare and implement a cultural resources management plan for the Kellogg Creek watershed	LS
Kellogg Reservoir	2. Potential impacts on 84 cultural resource sites that may be eligible for the NRHP	See mitigation measure for impact 1 above	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
Desalination/EBMUD Emergency Supply	3. Potential impacts on 42 cultural resource sites that may be eligible for the NRHP	See mitigation measure for impact 1 above	LS
Middle River Intake/EBMUD Emergency Supply	4. Potential impacts on 21 cultural resource sites that may be eligible for the NRHP	See mitigation measure for impact 1 above	LS
HUMAN ENVIRONMENT			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir			
All configurations	1. Relocation of residents from eight residences within the Kellogg Creek watershed	No mitigation is available to reduce this impact to a less-than-significant level; CCWD will fully compensate landowners and provide relocation assistance pursuant to state law	S
	2. Conflict of the Los Vaqueros pipeline with a proposed development north of the Kellogg Creek watershed. Because no approvals have been issued for this project, the magnitude of this conflict cannot be determined	CCWD should, to the extent cost effective, coordinate siting of the Los Vaqueros pipeline with developers to minimize impacts on proposed future developments	LS
	3. Provision of substantial recreation opportunities within the Kellogg Creek watershed	No mitigation is required	B
Rock Slough/Old River No. 1 configuration	4. Potential loss of important domengine sandstone resources along the pipeline alignment	No mitigation is available	S
Rock Slough/Old River No. 2 configuration	5. Conflict with a small agricultural processing and storage facility at the intake facility site	CCWD should construct a new access road immediately west of the agricultural processing complex	LS
	6. Possible removal of or disruption to one rural residence north of the East Contra Costa Irrigation District (ECCID) canal and west of Byron Highway	CCWD should relocate the pipeline to avoid this conflict	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	7. Possible removal of or disruption to one rural residence adjacent to the ECCID canal and west of Walnut Boulevard	No mitigation is available to reduce this impact to a less-than-significant level; CCWD will fully compensate landowners and provide relocation assistance pursuant to state law	S
Rock Slough/Old River No. 3 configuration	See impacts and mitigation measures 6 and 7 above		
	8. Restricted access to the Cruiser Haven Marina during intake facility construction	CCWD should maintain access to the marina during construction	LS
	9. Conflict with development proposal in advanced planning stages	CCWD should coordinate siting of the Old River No. 3 pipeline with developers to minimize impacts on this development	LS
Rock Slough/Old River No. 4 configuration	See impacts and mitigation measures 6, 7, and 9 above		
Rock Slough/Old River No. 5 configuration	See impact and mitigation measure 5 above		
Rock Slough/Old River No. 6 configuration	No significant impacts were identified		
Rock Slough/Clifton Court Forebay configuration	No significant impacts were identified		
Kellogg Reservoir	See impacts and mitigation measures 1 and 5 above		
Desalination/EBMUD Emergency Supply	10. Relocation of residents from 1 residence at the desalination plant site	See mitigation measure for impact 1 above	S
	11. Conflict with development now under construction, requiring the removal of structures	CCWD should relocate the pipeline to avoid removing or substantially modifying structures	LS
Middle River Intake/EBMUD Emergency Supply	See impact and mitigation measure 8 above		
	12. Conflict with a cement plant, a natural gas pumping plant, and a rural residence	Relocating the pipeline is infeasible in these areas; therefore, no mitigation is available to reduce these impacts to less-than-significant levels	S

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	13. Conflict of the Middle River pipeline with a proposed development within the north Brentwood redevelopment area, which is in advance planning stages	CCWD should relocate this portion of the Middle River pipeline to avoid modifying this proposed project	LS
TRANSPORTATION			
No Action	1. One intersection and one roadway segment would operate at an unacceptable level of service in 1995, and four additional roadway segments would operate at an unacceptable level of service in 2005	Appropriate transportation agencies could signalize the Oak Avenue/Walnut Boulevard intersection, add a right-turn lane to the eastbound approach of Camino Diablo Road to the County Line Alignment (Modified), widen the County Line Alignment (Modified) to four lanes, and widen Vasco Road to four lanes between its intersection with the County Line Alignment (Modified) and I-580 to eliminate impacts that would occur under 1995 conditions; appropriate transportation agencies could widen Camino Diablo Road to four lanes east of the County Line Alignment (Modified) and widen the County Line Alignment (Modified) to four lanes between Walnut Boulevard and Camino Diablo Road to eliminate impacts that would occur under 2025 conditions	LS
Los Vaqueros Reservoir and Kellogg Reservoir	2. One additional intersection would operate at an unacceptable level of service in 1995; no additional impacts would occur in 2025	CCWD should install a right-turn acceleration lane from southbound Vasco Road to southbound County Line Alignment (Modified) and add a left-turn lane to the County Line Alignment (Modified)/Vasco Road intersection	LS
	3. Construction of the alternate intake facilities and water conveyance pipelines would result in traffic delays on several major routes	CCWD should implement proper construction management techniques	LS
Desalination/EBMUD Emergency Supply	4. Construction of the desalination plant and associated pipelines would result in traffic delays on several major routes	CCWD should implement proper construction management techniques	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
Middle River Intake/EBMUD Emergency Supply	See impact and mitigation measure 3 above		
AIR QUALITY			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir and Kellogg Reservoir	1. Emission of approximately 3,300 pounds per day of particulate matter smaller than 10 microns in diameter during construction	No mitigation is available	S
	2. Emission of greater than 150 pounds per day of ozone during construction	No mitigation is available	S
	3. Emission of 100-180 pounds per day of reactive organic compounds and 254-455 pounds per day of nitrogen oxide emissions from recreation-related traffic	CCWD should encourage extension of public transit and investigate use of a low-emission vehicle for the proposed watershed shuttle system	S
Desalination/EBMUD Emergency Supply	No significant impacts were identified		
Middle River Intake/EBMUD Emergency Supply	No significant impacts were identified		
NOISE			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir	No significant impacts were identified		
Kellogg Reservoir	1. Increased noise levels near residences during dam construction	CCWD should implement noise-reducing practices, including restricting activities within 1,000 feet of residences to daytime hours on weekdays, maintaining proper sound-control devices on equipment, avoiding pile-driving and blasting operations within 3,000 feet of residences to daytime hours on weekdays, avoiding or buffering rock-crushing operations within 3,000 feet of residences, and implementing other noise-control measures as required by Contra Costa County	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
Desalination/EBMUD Emergency Supply	No significant impacts were identified		
Middle River Intake/EBMUD Emergency Supply	No significant impacts were identified		
PUBLIC SERVICES			
No Action	No significant impacts were identified		
Los Vaqueros Reservoir and Kellogg Reservoir	1. Increased response time to fires from the California Department of Forestry's Sunol station caused by relocating Vasco Road	CCWD should reorganize access areas after fire agency review of local roadway and fire trail network	LS
	2. Increased demand on landfill capacity caused by need to dispose of 3,000 cubic yards of major structures, 5,500 cubic yards of woody vegetation, and 10,000 cubic yards of asphalt	CCWD should deposit wood waste at a suitable wood-waste recovery facility and recycle waste asphalt	LS
	3. Potential damage during intake and pipeline construction to roadways not designed for heavy truck use	CCWD should reroute heavy truck traffic to routes designed for heavy truck use, or inspect, monitor, and repair damage to roads not designed for heavy truck use	LS
	4. Lack of identified methods to dispose of sewage generated by recreation uses	CCWD should identify and implement sewage treatment by constructing and operating vault toilets, or constructing and operating a wastewater treatment plant, or reserving capacity in nearby future wastewater facilities	LS
	5. Lack of identified methods to meet treated water demands generated by recreation uses	CCWD should implement water conservation measures and operate a water treatment and distribution system	LS
	6. Lack of identified drainage improvements to accommodate increased runoff from parking and other developed areas	CCWD should construct appropriate drainage improvements	LS

Note: S = significant; LS = less than significant; B = beneficial.

Alternative	Significant Impact	Mitigation Measure	Level of Significance with Mitigation
	7. Increased demand on solid waste disposal services caused by recreation uses	CCWD should develop and implement a recycling program and negotiate a contract with Alameda County to accept solid waste, or deliver solid waste to a new Contra Costa County landfill when opened	LS
	8. Increased demand for non-traffic-related law enforcement services caused by recreation uses	CCWD could: a) employ a law enforcement service, b) negotiate and implement a contract with the Contra Costa County Sheriff's Department, or c) negotiate and implement a contract with East Bay Regional Park District	LS
	9. Increased demand for traffic-related law enforcement caused by recreation uses	The California Highway Patrol should hire one or two additional officers to patrol beat 053	LS
	10. Increased demand for fire protection services caused by recreation uses	CCWD should implement fire prevention measures, including implementing vegetation management, providing fire hydrants, and restricting use of fire and barbecues	LS
	11. Increased expenditures from Contra Costa County general fund to provide services	See mitigation measures for impacts 2 and 8 above	LS
	12. Increased expenditures by local fire districts to provide fire protection services	See mitigation measure for impact 10 above	LS
Desalination/EBMUD Emergency Supply	No significant impacts were identified		
Middle River Intake/EBMUD Emergency Supply	See impact and mitigation measure 3 above		

Note: S = significant; LS = less than significant; B = beneficial.

Note: S = significant; LS = less than significant; B = beneficial.

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Acronyms

230-kV	230,000-volt
AB	Assembly Bill
ABAG	Association of Bay Area Governments
ACWD	Alameda County Water District
ADT	average daily trips
af	acre-feet
af/mo	acre-feet per month
af/yr	acre-feet per year
AIRFA	American Indian Religious Freedom Act
APE	area of potential effect
BAAQMD	Bay Area Air Quality Management District
BART	Bay Area Rapid Transit
Bay	San Francisco Bay
BFPD	Byron Fire Protection District
BLM	U.S. Bureau of Land Management
Caltrans	California Department of Transportation
CCWD	Contra Costa Water District
CDC	California Department of Conservation
CDF	California Department of Forestry and Fire Protection
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CHP	California Highway Patrol
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
Corps	U.S. Army Corps of Engineers
CTRC	California Toll Road Company
cu yd	cubic yards (Ch.19)
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
D-1485	Decision 1485
dB	decibel
dBA	A-weighted decibel scale
dbh	diameter at breast height
DCC	Delta Cross Channel
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DHS	California Department of Health Services
DIDI	Delta Island Drainage Investigation
DPR	California Department of Parks and Recreation
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
DWRSIM	DWR's Central Valley Simulation Model
EC	electrical conductivity
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
ECCID	East Contra Costa Irrigation District
EDFPD	East Diablo Fire Protection District
EIR	environmental impact report

EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FDM	Fischer Delta Model
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
fps	feet per second
HSPF	Hydrologic Simulation Program-FORTRAN
I	Interstate
IDHAMP	Interagency Delta Health Aspects Monitoring Program
LARPD	Livermore Area Recreation and Park District
LCP	Local Coastal Plan
L_{dn}	day-night average sound level
L_{eq}	equivalent decibel scale
LOS	level-of-service
LVOPS	Los Vaqueros Operations Model
MCE	maximum credible earthquakes
MCL	maximum contaminant level
mg/l	milligrams per liter
mgd	million gallons per day
mm	millimeters
mmhos/cm	millimhos per centimeter
MMWD	Marin Municipal Water District
MOA	memorandum of agreement
MOU	memorandum of understanding
NAHC	Native American Heritage Commission
NDDB	Natural Diversity Data Base
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOP/NOI	notice of preparation and notice of intent
NRHP	National Register of Historic Places
OES	Office of Emergency Services
OHP	State Office of Historic Preservation
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter
PMF	probable maximum flood
ppb	parts per billion
ppm	parts per million
PROSIM	Central Valley Simulation Model
psi	pounds per square inch
RBDD	Red Bluff Diversion Dam
RDM	residual dry matter
Reclamation	U.S. Bureau of Reclamation
RIS	reservoir-induced seismicity
RWQCB	Regional Water Quality Control Board
SBA	South Bay Aqueduct
SCS	U.S. Soil Conservation Service
SCVWD	Santa Clara Valley Water District
SFRWQCB	San Francisco Bay Regional Water Quality Control Board
SOI	sphere of influence
SR	State Route
SRFPD	San Ramon Fire Protection District
SS	suspended sediment
SSU	Sonoma State University
State CEQA Guidelines	California Environmental Quality Act Guidelines
SWA	Solano Water Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board

TAF	thousand acre-feet
TDS	total dissolved solids
TFPD	Tassajara Fire Protection District
THM	trihalomethane
THMFP	trihalomethane formation potential
TSP	total suspended particulate matter
TWSA	Treated Water Service Area
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V/C	volume-to-capacity
VMT	vehicle miles traveled
WAPA	Western Area Power Administration
YCWA	Yuba County Water Agency

Chapter 1. Purpose of and Need for the Los Vaqueros Project

BACKGROUND

Contra Costa Water District (CCWD) of Concord, California, originally known as Contra Costa County Water District, was formed in 1935 under the authority of the State Water Code. CCWD purchases its water supply from the Central Valley Project (CVP), operated by the U.S. Bureau of Reclamation (Reclamation). The State Water Code empowers CCWD to perform any activity necessary to furnish water for a present or future beneficial use within CCWD's boundaries (Figure 1-1). CCWD operates both raw water distribution facilities and water treatment and treated water distribution facilities. CCWD presently supplies raw water to Antioch, Oakley Water District, Pittsburg, Southern California Water Company (serving West Pittsburg), Martinez, 10 major industries, 36 smaller industries and businesses, and approximately 35 agricultural users. Approximately 400,000 customers receive water from CCWD, including wholesale and retail customers throughout north-central and east Contra Costa County.

The Contra Costa Canal system is CCWD's principal water supply and delivery system (Figure 1-1). This system obtains water diverted directly from the Delta and from flows from the CVP storage releases from Shasta, Folsom, and Trinity Reservoirs into the Sacramento River rediverted in the Delta to CCWD's system at Rock Slough. Diversions and rediversions are then made in the Sacramento-San Joaquin Delta (Delta) to CCWD's system at Rock Slough. Under Water Service Contract I75r-3401 (amended) with Reclamation, CCWD can divert up to 195,000 acre-feet per year (af/yr) of water from Rock Slough. Because of physical constraints in CCWD's delivery system, however, approximately 135,000 af/yr can be delivered at this time based on historic diversion patterns. Currently, CCWD diverts approximately 120,000-130,000 af/yr of water from Rock Slough depending on the year type. CCWD can also divert up to 26,780 af/yr of water from Mallard Slough in the Delta (Water Rights License No. 3167 and Permit No. 19856). This diversion has been made in lieu of diverting water through the Contra Costa Canal, but only minor diversions have been made from Mallard Slough in recent years because of unacceptable water quality.

NEED TO IMPROVE WATER QUALITY

Since 1940, CCWD has obtained its water from the Delta, which is subject to wide variations in salt and mineral concentrations. This single source of water supply also has made CCWD and its customers vulnerable to any artificial or natural phenomenon that could cause a catastrophic deterioration of Delta water quality.

The diversion point for CCWD's water from Reclamation, Rock Slough, fluctuates in salinity (dissolved salts) when salt water intrudes from the San Francisco Bay (Bay) in dry years and, to a lesser extent, when Delta agricultural drainage occurs, especially during wet periods. Saltwater intrusion typically occurs during summer, and Delta agricultural drainage problems generally occur in winter.

The most serious rise in salt concentration at Rock Slough occurs during dry and critical years. When Sierra Nevada and Cascade Range runoff and releases from storage are ample, the rivers flowing into the Delta create a freshwater barrier that prevents the salty water of the Bay from intruding into the Delta in large amounts. Water quality degrades, however, during dry periods, such as the droughts of 1928-1935, 1976-1977, and the present drought. Delta export pumping by the CVP and State Water Project (SWP) in the southern Delta exacerbates the problem by further reducing the freshwater outflow to the Bay.

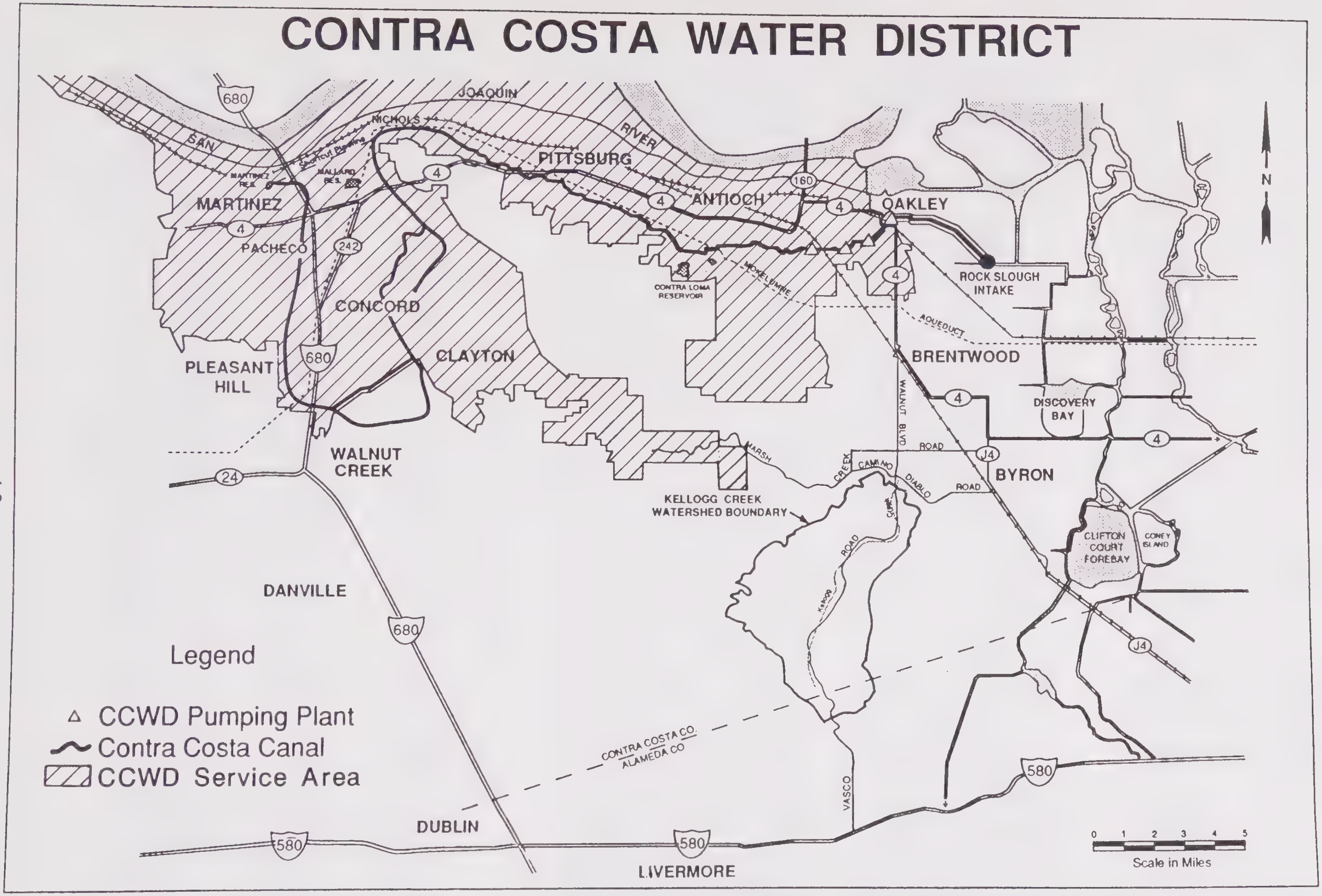

Figure 1-1. CCWD Existing Primary Water Conveyance and Storage Facilities

These water quality changes in Delta water are noticeable to those who drink the water or use the water in commercial and industrial processes. The typical seasonal degradation in water quality as Delta salinities increase is objectionable to many CCWD customers, costly to all residential and industrial users, and a health risk for some individuals.

CCWD is committed to supplying its customers with the highest quality water practicable and providing all reasonable protection of the supply from any known or potential source of hazardous contamination. CCWD Resolution No. 88-45 states in part that:

> CCWD is committed to reducing the concentration of sodium and chloride in the District's water, thereby reducing household and landscape irrigation concerns and industrial and manufacturing costs caused by the fluctuating sodium and chloride level of the District's Delta source. . . .

CCWD-treated water consistently meets all existing state and federal primary (health- related) drinking water standards. It may be difficult to meet primary drinking water standards expected to be established by the U.S. Environmental Protection Agency (EPA) in the near future without modifying CCWD's treatment processes. Necessary equipment modifications to meet anticipated primary drinking water standards are being planned at CCWD's existing water treatment plant and are being incorporated into the construction of the Randall-Bold Water Treatment Plant.

CCWD's conventional water treatment processes, however, do not lower the concentration of parameters for which secondary standards exist, such as sodium, chloride, total dissolved solids (TDS), and water hardness. These parameters diminish the overall water quality delivered to municipal customers and industry. Existing secondary (aesthetic and consumer-acceptance-related) standards for chloride and TDS sometimes cannot be met with the present CCWD system, particularly during critical years. Levels of sodium and water hardness, and associated health risks to some individuals, also can be high during periods of water quality degradation.

In May 1987, CCWD's Board of Directors adopted desired quality objectives for water distributed within its service area. The acceptable levels of sodium and chloride were established at 50 milligrams per liter (mg/l) and 65 mg/l, respectively. Concentrations of these parameters as measured at Rock Slough have frequently exceeded this goal (Figure 1-2). For comparison, the chloride levels in drinking water of nearby East Bay Municipal Utility District (EBMUD) are approximately 2-5 mg/l.

NEED TO IMPROVE WATER RELIABILITY

CCWD's water is also vulnerable to Delta emergencies, including those from chemical spills, agricultural drainage, and levee failures. For example, the Andrus Island levee failure in June 1972 caused Rock Slough chloride concentrations to increase to nearly 450 mg/l, almost twice the secondary maximum contaminant level for chloride content in drinking water (250 mg/l).

The CCWD system is dependent on nearly continuous operation of all four of its pumping plants along the Contra Costa Canal. If any one of these facilities were forced out of service because of a Delta levee failure, severe earthquake, drought, Delta chemical spill, or other Delta water quality problems, CCWD could meet unconstrained water demands for only a few peak days by drawing from its existing small storage reservoirs (Contra Loma, Martinez, and Mallard), which provide a combined total of approximately 5,000 acre-feet (af) of water when full.

This 3- to 5-day supply during peak demands (equivalent to a 7- to 10-day supply during average demands) is insufficient for a district serving water to approximately 400,000 customers and numerous industries and businesses. The CCWD canal system consists of a chain of components, and failure of any

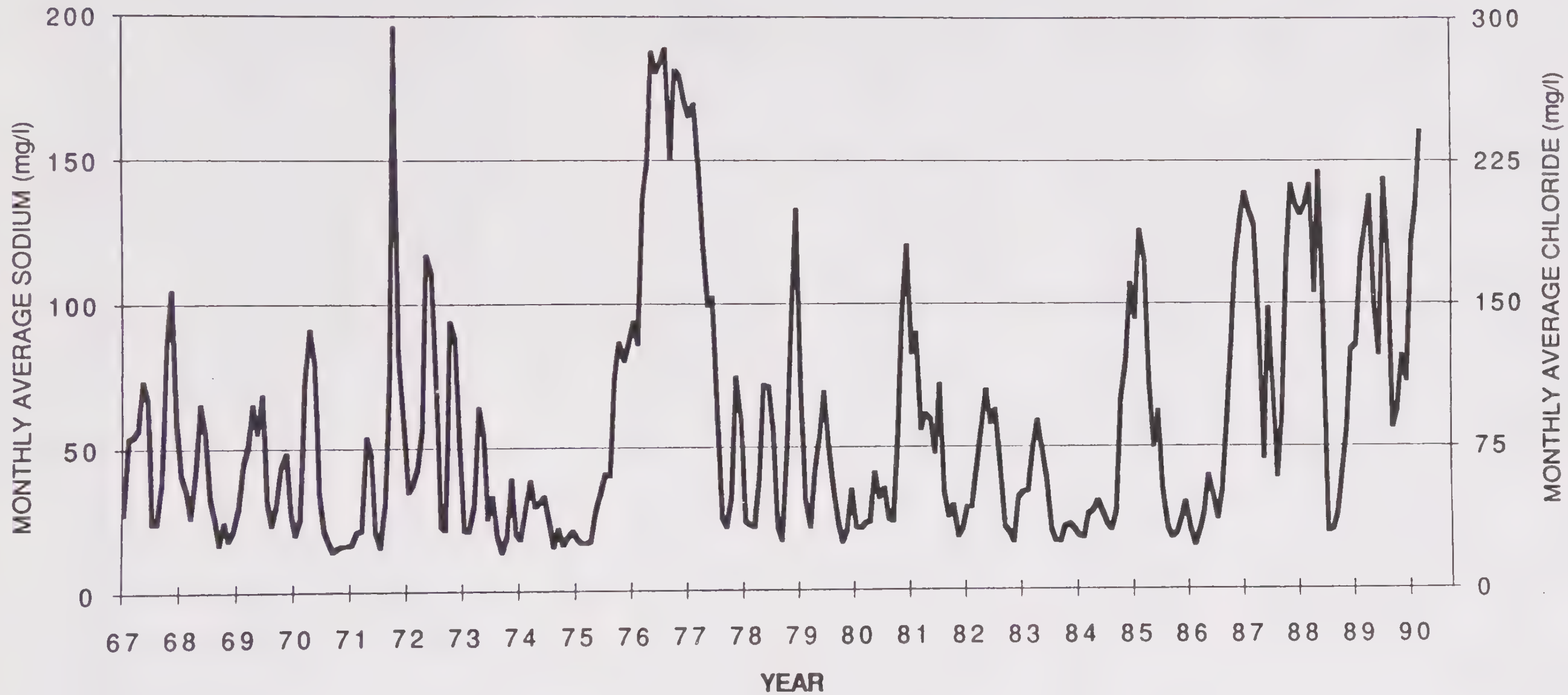

Figure 1-2. Historic Rock Slough Sodium and Chloride Concentrations

individual unit jeopardizes operation of the entire system. Additional reliability storage is necessary in the event of protracted supply disruptions that could result from Delta levee failures, chemical spills, drought, or a severe earthquake.

Nearby water districts and water agencies in southern California maintain emergency supplies substantially greater than current CCWD supplies. For instance, EBMUD has an emergency storage equivalent to 120 days of average daily demand, the City of San Francisco has reserve storage equivalent to 130 days of average daily demand, and Alameda County Flood Control and Water Conservation District maintains emergency storage of about 136 days of average daily demand. In southern California, San Diego County Water Authority has reserve storage equivalent to 60-90 days of average daily demand, and Metropolitan Water District of Southern California maintains emergency storage of about 90 days of average daily demand.

CCWD conducted detailed risk analyses and concluded that reliability storage should be sufficient to satisfy 3 months of demand during peak water use at buildout of its system in 2025 (56,000 af) in the event of an emergency. Customer cutbacks of an additional 25% over and above current conservation measures are assumed during the emergency. A total of 26,000 of the 56,000 af of emergency storage could be used to enhance water quality during dry and critical years. The remaining 30,000 af of reliability storage (estimated 1 peak-month demand in 2025) are to be used only for emergencies that threaten CCWD's water supply and its ability to provide water service for domestic, sanitary, and fire protection purposes. Such emergencies would include those that threaten CCWD's ability to meet all state and federal primary drinking water standards.

PROJECT PURPOSE AND OBJECTIVES

Primary Objectives

CCWD's basic project purpose is to improve the quality of water supplied to CCWD customers and minimize seasonal quality changes, and to improve the reliability of the CCWD supply. This project purpose has been identified since the 1960s. Recently, detailed engineering studies and economic evaluations have shaped the development of specific project objectives and planning assumptions to facilitate project design.

CCWD's specific primary goals and objectives are:

1. to improve the quality of water supplied to CCWD customers and minimize seasonal quality changes, specifically by providing consumers with water quality at the tap of 65 mg/l chloride and 50 mg/l sodium 100% of the time; to supply CCWD customers with the highest quality water practical; and to provide all reasonable protection of the supply from any known or potential source of contamination hazard;

2. to improve the reliability of the CCWD supply by providing for emergency storage to supply 75% of the maximum projected 3-month demand in 2025 (56,000 af), with the provision that up to 26,000 af of this emergency storage can be used to enhance water quality during dry and critical years; and

3. to meet these water quality and reliability objectives by developing and constructing a project by 1995 with an estimated cost to CCWD in 1988 dollars of $350 million and by minimizing costs (CCWD Resolution No. 88-45).

Secondary Objectives

Secondary objectives consistent with the primary water quality and reliability objectives and stated in Resolution No. 88-45 are to:

1. provide flood control benefits,
2. maintain and enhance fish and wildlife resources, and
3. offer recreational opportunities.

Other objectives, which may be considered as planning objectives, include such concerns as environmental acceptability, flexibility, ability to supply all CCWD customers, institutional considerations, and practicality. Certain objectives also serve as specific criteria for evaluating the proposed project and alternatives. These objectives are to:

- provide an environmentally acceptable project,
- provide an energy-efficient project,
- provide for flexibility in operating and managing the reservoir,
- not operate the project in conjunction with a peripheral canal or increase the export of Delta water from northern California without additional voter approval, and
- provide fishery benefits in the Delta to the extent practicable.

PROJECT PLANNING ASSUMPTIONS

Several important assumptions have been made for planning potential project alternatives to meet CCWD's project purposes. The most basic of these are the projected water demands for the future CCWD service area. The water demand projections are described below. Detailed information regarding the development of these water demands are contained in CCWD's draft Section 404(b)(1) Alternatives Analysis for Meeting Water Quality and Reliability Objectives (1991b), available from CCWD.

Planning Area

CCWD developed several water demand scenarios as a part of its planning process using the planning areas shown in Figure 1-3. Buildout water demands were estimated for the potential planning areas based on planned land uses and the "water duty" method. The planned land uses were inventoried based on approved general plan land use maps for each city and the September 1989 draft of the Contra Costa County general plan. A water duty is the estimated total annual amount of water used per acre of a specific land use. Annual water demands were calculated by multiplying the water duty by the number of acres of a particular land use. Water demands were estimated for buildout conditions. Buildout is defined as the point at which all land is fully developed according to existing general plan land use plans and guidelines for development. The buildout demand projections were then adjusted to reflect long-term conservation practices and system water losses.

The planning area for the Los Vaqueros Project is defined as the service area as of fall 1989 (CCWD's existing boundaries and sphere of influence [SOI]) and the areas that extend beyond this boundary that are within the planning jurisdiction of CCWD raw water customers: the Oakley Water District and its

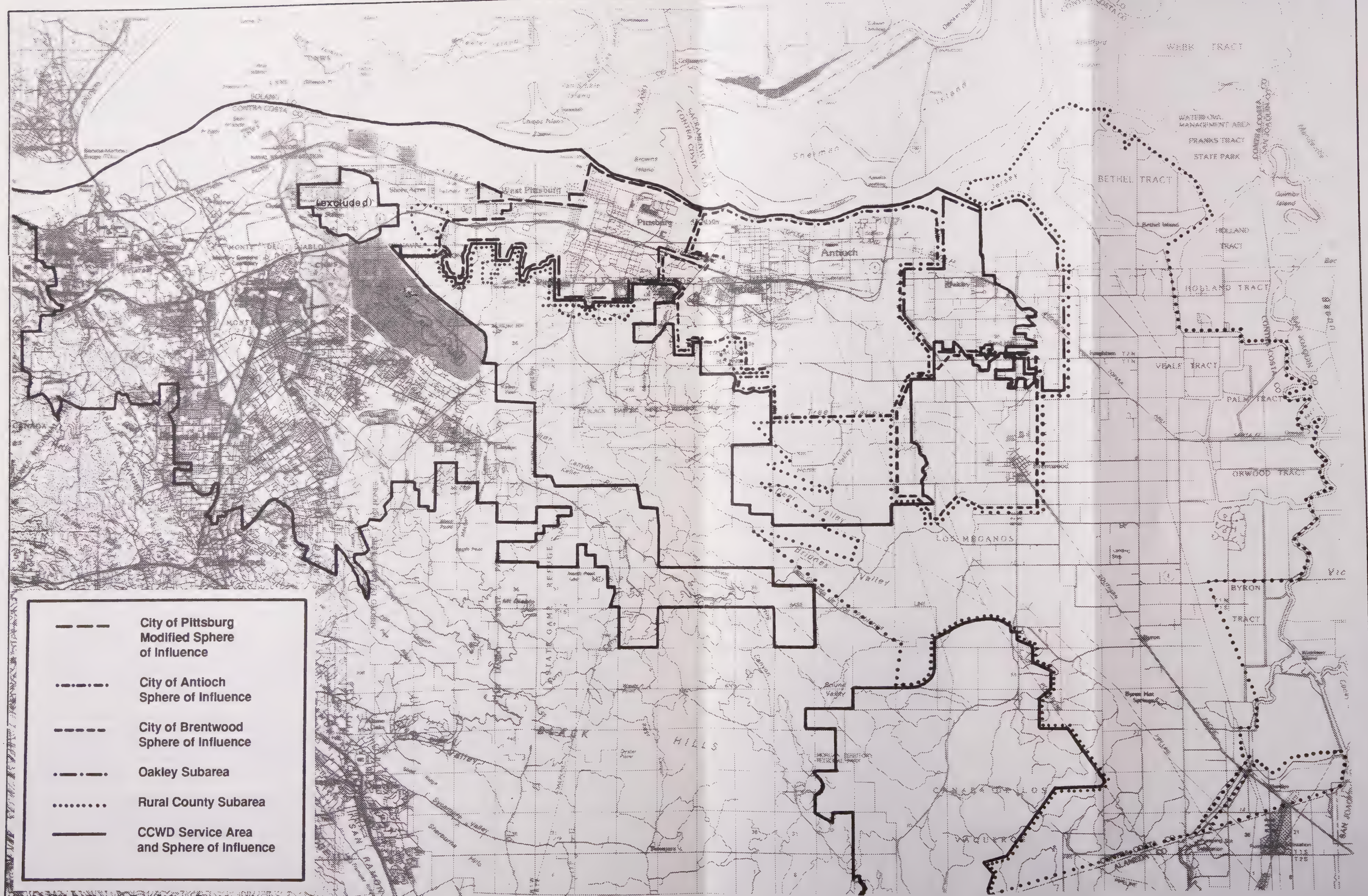

Figure 1–3. Planning Area Boundaries

planning area and several parcels within the City of Antioch's SOI that are outside of CCWD's SOI. These additional areas were included because they are likely to be served by CCWD as these retail agencies expand service within their planning areas. Project demands were based on the land use designations contained in current city general plans and the 1989 draft of the Contra Costa County general plan.

Specifically, the planning area includes the:

- CCWD boundary and SOI,
- City of Pittsburg modified SOI,
- City of Antioch SOI,
- Oakley Water District planning area, and
- City of Martinez water service boundary.

Water Demands

Table 1-1 shows the average total Contra Costa Canal demands for the planning area at full buildout. Average Contra Costa Canal critical-year demands (drought conditions) at buildout are projected to be 205,800 af/yr, slightly in excess of CCWD's 195,000 af/yr water supply contract with Reclamation. When projected savings from conservation and reclamation are factored into these buildout demands, however, average total Contra Costa Canal demands are projected to be 188,000 af/yr in critical years. Table 1-1 also shows projected average Contra Costa Canal demands in years other than critical years. In noncritical years, total Contra Costa Canal demands are projected to average 174,600 af/yr.

The difference between critical-year and noncritical-year demands is primarily a result of variations in diversions by several industries near Antioch. CCWD, Antioch, and several of these industries divert water directly from the San Joaquin River. During critical years, however, chloride concentrations in the San Joaquin River increase substantially, thereby increasing costs of water treatment to certain industries or otherwise rendering the water unusable. Therefore, during critical years these industries typically decrease direct diversions from the San Joaquin River and increase diversions from the Contra Costa Canal. These differences in diversions are reflected in Table 1-1.

It should be noted that major industrial customers initiated conservation programs during the 1976-1977 drought that resulted in some permanent reductions in water use. Water rates for major industrial customers have increased almost tenfold since the 1976-1977 drought (from $35 per af to $325 per af) and have tripled over the last 3 years, providing further incentives for industries to conserve. In addition, conservation during short-term emergencies is made more difficult because some industrial demands increase as water quality worsens. In planning for the 1991 drought, industrial users have indicated that cutbacks over 10% will cause hardships. CCWD instituted a mandatory program for 1991 requiring a 15% reduction in industrial water use and a 26% reduction among customers overall. This program was later modified to require a 15% voluntary reduction plan for all customer classes. Based on this information, no long-term conservation has been assumed for the major industries. It is assumed that major industrial water use could be reduced by 10-15% during short-term emergencies by reducing production.

Note that the demands shown in Table 1-1 are projections made without taking statistical variations into account. Estimates (both with and without statistical variation) are intended for planning purposes. The forecast demands were based on historical data and other planning and engineering assumptions. There are, however, several factors that could contribute to deviation from the demands shown in Table 1-1. These factors include:

- cyclic and seasonal weather variations,
- economic conditions,
- measurement inaccuracies,

Table 1-1. Projected Average Annual Buildout Contra Costa Canal Demands in Acre-Feet

	Critical Years	Noncritical Years
Antioch	26,100	23,300
Martinez[a]	5,600	5,600
Pittsburg[b]	13,600	13,600
Oakley Water District[c]	11,300	11,300
CCWD (TWSA)[d]	72,700	68,700
Rural[e]	4,300	4,300
Minor uses[f]	4,200	4,200
Subtotal	137,800	131,000
Industry[g]	47,400	41,000
Subtotal	185,200	172,000
Water losses[h]	20,600	20,000
Subtotal	205,800	192,000
Conservation[i]	(8,200)	(7,800)
Reclaimed water	(9,600)	(9,600)
Total canal demands[j]	188,000	174,600

[a] Demands for City of Martinez service area. Demands in Martinez for areas receiving treated water from CCWD are included in treated water service area (TWSA) demands.

[b] Demands do not include West Pittsburg. West Pittsburg demands are included in CCWD TWSA demands (James M. Montgomery, Consulting Engineers 1987).

[c] Consists of demands within the Oakley Water District and its planning area.

[d] Projected demands from the TWSA master plan were reduced 1,600 af/yr because of the anticipated change in the treated water supplier for lands southwest of the City of Pittsburg.

[e] Estimated demands for areas within CCWD's existing SOI and service area that are outside other municipal suppliers' planning area boundaries.

[f] Minor uses are the existing canal sales for minor municipal and industrial users, flat rate, and agricultural users. It is assumed these demands will not increase.

Table 1-1. Continued

[g] Industry represents demands of the five major industrial raw water customers of CCWD. Demands are based on factors such as historic Contra Costa Canal sales during critical and noncritical years and San Joaquin River water rights.

[h] Water losses are system losses such as canal seepage, reservoir evaporation, hydrant usage, canal cleaning and distribution system losses. Losses from treated water systems are estimated as a percentage of the total volume of water treated and passing through the treated water systems. While measures such as pipeline replacement programs may cause the percentage of loss to decrease over the short-term, the percentages used represent long-term average conditions and are within the range of losses considered acceptable and typical by the industry. Raw water losses do not increase as the volume of water traveling through the Contra Costa Canal increases. The estimated raw water losses represent average annual conditions and would vary from year to year, depending on factors such as weather conditions and canal maintenance.

[i] Estimated future savings from conservation represent an average of about 6% of the projected municipal demand. Estimated savings vary with each community depending on various factors, such as planned land uses: Antioch, 7%; Martinez, 1%; Pittsburg, 5%; Oakley Water District, 8%; TWSA and minor uses, 5%; and rural, 11%. In noncritical years, additional conservation savings may be realized for other water sources, such as river diversions.

[j] Demands listed are engineering estimates for the average year of the indicated type at buildout. Actual buildout canal demands may exceed the average values listed by 5% or more. These demands, however, would not be 5% or more below average values.

- policy changes,
- water quality effects, and
- statistical variations in planning projections.

Demands listed are engineering estimates for the average year of the indicated type at buildout. Because of variations in weather, water quality, future rate structures, and economic conditions and uncertainties associated with measurement inaccuracies, CCWD policies, and conservation and reclamation, the actual canal demands at buildout may exceed the projected buildout canal demands. It is reasonable to expect that, in some years, actual buildout canal demands may exceed the average values listed by 5% or more. The resulting critical-year buildout canal demand would then be 197,400 af/yr, and the resulting noncritical-year buildout canal demand would be 183,300 af/yr.

APPROACH TO OPERATIONS MODELING

Each of the project alternatives under consideration would change the timing, location, and volume of water diverted from the Delta as compared to existing conditions. To determine the probable magnitude and effect of these changes, and to evaluate the ability of the alternatives to meet CCWD's project objectives, CCWD has used available technology to extensively model the Delta and upstream reservoir and river systems. Hydrologic, salinity, and alternative reservoir operations models were developed as summarized below.

Hydrologic Models

Effects on upstream rivers and reservoirs in the CVP system were modeled using California Department of Water Resources' (DWR's) Central Valley Simulation Model (DWRSIM), a computer planning simulation model that describes changes in reservoir storage, riverflows, Delta inflow, Delta outflow, and Delta export based on hydrologic conditions that occurred between 1922 and 1978. DWRSIM incorporates operation rules for both the CVP and SWP. Physical facilities, water demands, and regulatory requirements can be modified in the DWRSIM model to estimate upstream reservoir, river, and Delta hydrologic conditions under various alternatives and operations.

Three simulations using DWRSIM were performed for this Stage 2 environmental impact report/ environmental impact statement (EIS): existing conditions, future conditions without new Delta water transfer facilities, and cumulative future conditions with new Delta water transfer facilities. CCWD and Reclamation believe that these three simulations provide a reasonable range of conditions against which to evaluate the project alternatives.

Existing conditions were simulated using model run A7, which DWR prepared for the SWRCB's Bay-Delta hearings. This model run simulates a 1990 level of development (i.e., water demand) with existing Delta and Central Valley system facilities. This study assumes that both the CVP and SWP would be operated to meet all Decision 1485 (D-1485) standards. Model run A7 is operated according to SWRCB D-1422 and two subsequent agreements: the October 1986 interim agreement between the South Delta Water Agency, Reclamation, and DWR; and the June 1987 agreement between the California Department of Fish and Game (DFG) and Reclamation that sets interim instream flow standards on the Stanislaus River below New Melones Dam.

Future conditions were simulated using model run 543. This scenario provides one component of the cumulative impact analysis contained in this EIR/EIS. Although no new Delta-related facilities are assumed in this simulation, future water demands by CCWD and other water diverters are included. In this model simulation, CCWD diversions are increased from the 120,000-130,000 af/yr under existing conditions

to CCWD's full buildout demands of 174,600-188,000 af/yr. These water demands will require constructing new local facilities to allow diversion and use of the water. This study is based on SWP buildout demands and CVP demands at year 2000. Reclamation has indicated to DWR, however, that CVP demands previously projected for 2000 are applicable to buildout conditions, given the assumption that no new facilities are constructed and that pumping at the SWP Harvey O. Banks Pumping Plant is limited by current permit restrictions imposed by the U.S. Army Corps of Engineers (Corps). Increased demands on the CVP have occurred more slowly than previously projected by Reclamation. Model run 543 was developed by DWR as a base case for its proposed Los Banos Grandes Reservoir project.

Cumulative future conditions, which assume the construction of new facilities, were simulated using model run 476. This model run assumes that new through-Delta water transfer facilities are in place to allow the existing pumping restrictions to be lifted and allow the Harvey O. Banks Pumping Plant to divert water at full capacity. Other assumed new facilities include a 1-million-af capacity in the Kern Water Bank and a 1.73-million-af capacity in Los Banos Grandes Reservoir. SWP buildout demands and CVP demands identical to those for model run 543 are assumed. Under the assumptions contained in this model run, however, the SWP's ability to meet demands on its system is improved and, consequently, additional Delta diversions occur. CCWD's demands are the same as those described above for future conditions.

To more accurately reflect existing and projected future conditions, CCWD modified its demands in each of these model runs based on the most current data and then performed new simulations. Model run A7 was modified to reflect current CCWD diversions, which vary between critical and noncritical years as described above. Model runs 543 and 476 were modified to reflect the projected CCWD buildout demands also described above. CCWD ran each of these models with these modifications to provide a baseline no-action condition against which to evaluate the effects of the project alternatives. CCWD further revised the model runs to reflect operations under each of the project alternatives. Output from DWRSIM was then used by CCWD as input to Version 8 of the Fischer Delta Model (FDM).

A complete list of assumptions used in model runs A7, 543, and 476 are provided in the Stage 2 EIR/EIS Technical Report (bound separately).

Fischer Delta Model

The FDM uses Delta inflow, Delta outflow, and Delta export information developed through DWRSIM to calculate the flow and TDS distribution in the network of Delta waterways. Version 8 is a variant of Version 7 and includes the capability of simultaneously calculating several water quality constituents, such as TDS and chlorides. Version 8 is also able to calculate the variation in salinity caused by tidal exchange at the downstream salinity boundary condition.

For these studies, the FDM was used to compute TDS concentrations at alternative intake locations for the 57-year period of 1922-1978. These TDS data are then converted to chloride concentrations using the TDS-to-chloride correlation equations developed by DWR. The hydrodynamic portion of the FDM computes flows at 90-second intervals. The salinity transport portion of the model computes TDS concentrations at 15-minute intervals. These small intervals are necessary to ensure computational stability in the smallest Delta channels. Riverflows and diversions are specified as monthly averages.

The downstream limit of the FDM is located at Eckley in the Carquinez Strait. The downstream boundary condition is the 19-year mean tide repeating on a 25-hour cycle. Monthly average rainfall and evaporation based on historical records for 1922-1978 are also included in the model calculations.

The FDM includes the effect of consumptive use and agricultural return flows in the Delta, but the return flows are applied at 23 locations throughout the Delta. Agricultural return flows can make a significant contribution to Delta water quality. In winter, high salinities caused by agricultural practices can often be

measured in the Delta. In this model, the timing, location, and spatial distribution of return flows are approximate.

Los Vaqueros Operations Model

For alternatives involving reservoir storage, CCWD developed the Los Vaqueros Operations Model (LVOPS). This model was used to determine when water could be taken from the Delta to fill a reservoir to meet CCWD's water quality objectives, which are described above. The maximum chloride concentration allowed when filling a reservoir with Delta water is set at 50 mg/l, and the reservoir is operated to maintain a maximum reservoir chloride concentration of 50 mg/l.

The simulations assume a potential filling period of November through June with filling restricted to periods when surplus flow is available from the Delta. The model assumes that the reservoir is filled only from the new supplemental intake associated with the reservoir alternatives and at a rate of 200 cubic feet per second (cfs). The simulations assume that direct diversions to the CCWD system would be taken from the intake location (i.e., existing Rock Slough or new supplemental intake) with the best water quality.

In the simulations conducted for the alternatives, the LVOPS model is operated within the FDM using a daily time step. The intake chloride concentration for a given day is calculated by the FDM and is used in the LVOPS to determine the Delta diversions for that day. This information is then incorporated into the FDM calculation of the next day's chloride concentration. Incorporating the LVOPS within the FDM greatly increases the accuracy of Delta operations modeling by linking Delta diversions and salinity. Because operation of the Los Vaqueros Reservoir and Kellogg Reservoir would alter CCWD diversions from the Delta, the resulting new demand schedule is incorporated back into DWRSIM and the FDM to recompute CVP operations and Delta salinities in an interactive process to improve model accuracy.

Model Precision and Accuracy

The models described above provide a reasonably accurate determination of surplus water availability, upstream reservoir storage and riverflows, and Delta salinity. However, because of the complicated and flexible procedures involved in managing the Central Valley water supply system, slight changes in operating rules could produce varying results. Although the intent of the modeling effort described above is to reflect forecasted operations of the CVP and project alternatives as closely as possible, accurately reflecting all aspects of actual operation with these models is infeasible. The primary value of the models is to facilitate comparisons of alternatives using a standard and consistent application of water supply operating principles.

PUBLIC AND AGENCY INVOLVEMENT

Details regarding the public involvement process for this EIR/EIS, including the notice of preparation/notice of intent (NOP/NOI), scoping meetings, scoping report, and regularly held coordination meetings with responsible and cooperating agencies, are presented in Chapter 20, "Consultation and Coordination". Permits and other approvals needed to implement the project alternatives also are described in Chapter 20.

PURPOSE OF JOINT STAGE 2 EIR/EIS

The alternatives for meeting the project purpose and need would require numerous federal, state, and local agency permits and approvals. In several cases, obtaining these permits and approvals requires demonstration of compliance with either the California Environmental Quality Act (CEQA) or the National Environmental Policy Act (NEPA). In response to these requirements, this EIR/EIS provides the environmental documentation necessary to describe the specific impacts of the alternatives. CCWD is lead agency for CEQA compliance. CCWD has requested an amendment to its existing Water Service Contract I75r-3401 (amended) with Reclamation to accommodate operation of the Los Vaqueros Project and modify certain repayment conditions. This federal action requires Reclamation's involvement as the federal lead agency responsible for NEPA compliance. The major approvals or decisions needed for project construction and operation include:

- project approval by the CCWD Board of Directors;
- decisions by Reclamation on contract amendments, revisions, and related matters;
- issuance of permits to construct a dam and appurtenant facilities, including permits under the Clean Water Act, Section 404 and Section 10 by the Corps, approval of the dam design by the California Division of Safety of Dams (DSOD), and stream alteration agreements with DFG;
- issuance of water rights permits by SWRCB to allow a storage reservoir and impoundment of Kellogg Creek waters;
- issuance of the National Pollutant Discharge Elimination System (NPDES) permit or a waiver from compliance with permit requirements; and
- amendments of local agency general plans to accommodate certain project features.

The federal, state, and local permits that may be required depending on the alternatives and project components that are ultimately selected, constructed, and operated for the project, are described in Chapter 20, "Consultation and Coordination".

STAGED EIR APPROACH

CCWD has followed a staged approach to environmental documentation for the Los Vaqueros Project under Section 15167 of the California Environmental Quality Act Guidelines (State CEQA Guidelines) because several discretionary approvals are required from government agencies, and some of the approvals have been granted more than 2 years before construction will begin. Staging allows agencies to deal with broad environmental issues in EIRs at planning stages and then to provide more detailed examination of specific effects in later EIRs as the project becomes more narrowly defined during the project planning process.

Staging is also appropriate because specific, discrete actions must be taken at both early and later stages for development of the Los Vaqueros Project; sufficient information necessary to provide a meaningful assessment of all potential environmental impacts may not be available when actions early in the project formulation process are required.

Environmental documentation for the Los Vaqueros Project includes the following series of reports:

- Los Vaqueros/Kellogg Project Stage 1 EIR,
- Vasco Road and Utility Relocation Project EIR, and
- Los Vaqueros Project Stage 2 EIR/EIS.

Los Vaqueros/Kellogg Project Stage 1 EIR

The Stage 1 EIR, which CCWD prepared and certified in 1986, evaluated a full range of project alternatives, provided an informed estimate of the environmental consequences of the project in general form, and documented potential environmental impacts of acquiring and managing the Kellogg Creek watershed lands.

A full range of reservoir and alternative concepts was evaluated for meeting project objectives. Five major alternatives were considered in the Stage 1 EIR and tested for their ability to meet project objectives. These included the Los Vaqueros Reservoir, Kellogg Reservoir, Kirker Creek Reservoir, desalination, and no action. Other alternatives considered infeasible for meeting project objectives included 10 other reservoir sites, groundwater management, and alternative water supply sources. At the completion of the Stage 1 EIR process, CCWD narrowed the range of options to reservoir concepts within the Kellogg Creek watershed as the only alternatives capable of achieving all project objectives. The Los Vaqueros Reservoir and Kellogg Reservoir sites (Figure 1-2) were the two primary reservoir sites selected; these reservoirs are still under consideration.

The Stage 1 EIR contains a general discussion of all identified potential impacts and provides an informed estimate of the potential range of consequences. The Stage 1 EIR allowed CCWD to begin acquiring Kellogg Creek watershed land. Detailed environmental analysis could not be conducted for the Los Vaqueros Project in the Stage 1 EIR because of the preliminary nature of project design; these analyses are the focus of this Stage 2 EIR/EIS.

The impacts of acquiring control of lands tributary to potential reservoir sites were addressed in detail in the Stage 1 EIR. Because water quality in the reservoir could be affected by surface runoff in the watershed, CCWD is acquiring the lands tributary to the watershed to control tributary land uses and the water quality of tributary streams. CCWD is acquiring nearly all of the watershed lands above the reservoir sites (approximately 19,600 acres) to protect the quality of water planned for storage. Watershed acquisition and management will preclude urban development in affected areas and preserve the quality of surface water runoff, as well as allow for use of watershed lands for wildlife enhancement, recreation, and other uses compatible with its water storage function.

Vasco Road and Utility Relocation Project EIR

CCWD certified the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990) in September 1990 under the State CEQA Guidelines to assess the impacts of relocating Vasco Road and several utility facilities. Vasco Road, an important county arterial roadway, and several utilities in the watershed would be inundated if a reservoir is constructed in the Kellogg Creek watershed.

The Los Vaqueros and Kellogg Creek dam sites lie directly across Vasco Road and certain utility lines. The road and affected utility facilities would need to be relocated before dam construction so that traffic flow and utility services would not be interrupted. Road and utility construction would start in late 1992 or early 1993 to permit dam construction in 1994-1995. The final Stage 2 EIR/EIS is also scheduled for completion in 1992, and road construction will not begin until the Stage 2 EIR/EIS is certified and Section 404 and Section 10 permits are obtained from the Corps. This tight schedule contributed to CCWD's decision to separate the EIR for the Vasco Road and utility relocation facilities from the Stage 2 EIR/EIS. The additional staging of the EIR process ensures that utility service will continue, that an acceptable alternative roadway will be in place before dam construction begins, and that the project will be completed by 1995.

CEQA requires that an EIR must provide state and local decision makers with information on the environmental consequences of those projects over which they have discretionary authority. Because decisions regarding the road and utility corridors affect jurisdictions beyond those directly affected by the water project, CCWD has prepared the Vasco Road and Utility Relocation Project EIR for review by Contra Costa and Alameda Counties and responsible state agencies. The EIR, focusing on the impacts of the road and utility relocations, is the best means of facilitating a thorough presentation and analysis of issues most important to local decision makers.

The Vasco Road and Utility Relocation Project EIR discusses, as does this Stage 2 EIR/EIS, the effects of all project components, as required by CEQA. The Vasco Road and Utility Relocation Project EIR, however, focused on the potential environmental effects of road and utility relocation, with overall project impacts addressed in a programmatic or general manner. The Vasco Road and Utility Relocation Project EIR provided the environmental documentation necessary for Alameda and Contra Costa Counties to amend their general plans as appropriate and to vacate portions of the existing county-owned Vasco Road. The pertinent analyses and conclusions are included in this Stage 2 EIR/EIS.

PARTICIPATION BY OTHER AGENCIES

CCWD has made continued and considerable attempts to facilitate participation in the Los Vaqueros Project since 1985. Benefits to CCWD, participants, and the environment could perhaps be realized from a joint-participation project. CCWD has encouraged and led discussions of regional water management issues and believes that good faith efforts to solicit participation have been extended to all potentially interested parties.

CCWD's efforts to solicit participation delayed the planning, study, and implementation of the proposed project. It is necessary to plan and analyze a specific project, as well as alternatives to the project, based on a specific project purpose. CCWD is pursuing that goal in light of decisions by other agencies to not participate. CCWD's aim is to improve water quality performance and emergency supplies by 1995. CCWD's efforts to attract participants to the Los Vaqueros Project and the results of those efforts are documented in Appendix B of CCWD's Section 404(b)(1) alternatives analysis dated September 1990 (Contra Costa Water District 1991b).

CCWD's current participation policy is to consider proposals from potential participants or water service contractors with objectives in common with CCWD, provided that the proposals include the necessary environmental, technical, water rights, and Corps Section 404 permit application documentation. This information will allow CCWD to determine whether the proposed project:

- would satisfy CCWD's basic project purposes and objectives;
- could be permitted, approved, and financed without delaying the CCWD-only project;
- includes environmental impacts unacceptable to CCWD; and
- increases costs to CCWD water users.

RELATED STUDIES INVOLVING THE DELTA

Table 1-2 lists other recent and ongoing studies and activities involving the Delta. Where appropriate, these projects have been included in cumulative impact analyses conducted for this Stage 2 EIR/EIS.

Table 1-2. Related Studies Involving the Delta

Study	Sponsor
Kellogg Unit Reformulation Study	Reclamation
Reclamation Offstream Storage Investigation	Reclamation
Water Quality Control Plan for the Sacramento-San Joaquin Delta	SWRCB
Coordinated Operations Agreement	Reclamation and DWR
Capacity Increase at Harvey O. Banks Pumping Plant	DWR
South Delta Water Management Program	DWR
North Delta Water Management Program	DWR
Los Banos Grandes Reservoir Project	DWR
West Delta Water Management Program	DWR
Delta-Mendota Canal/California Aqueduct Intertie Project	Westlands Water District and Reclamation
Delta Wetlands Project	Delta Wetlands Corporation
Central Valley Project Water Management	Reclamation
Consolidated Place of Use	Reclamation

Chapter 2. Alternatives Including the Proposed Action

INTRODUCTION

CCWD has undertaken considerable work in formulating the project alternatives evaluated in this EIR/EIS. Cost and engineering factors, water quality and reliability objectives, the Section 404 permit process, institutional considerations, and numerous environmental factors have had substantial influence in shaping the project alternatives, which include:

- No-Action Alternative,
- Los Vaqueros Reservoir Alternative (including seven alternate project configurations),
- Kellogg Reservoir Alternative,
- Desalination/EBMUD Emergency Supply Alternative, and
- Middle River Intake/EBMUD Emergency Supply Alternative.

ALTERNATIVES SCREENING AND SELECTION PROCESS

Both CEQA and NEPA require an EIR/EIS to describe and evaluate reasonable alternatives to a proposed project or to the location of the project. One of the alternatives that must be considered is the No-Project Alternative, which would maintain existing conditions. The State CEQA Guidelines state that the range of alternatives required to be evaluated in an EIR is governed by the "rule of reason"; the EIR needs to describe and evaluate only those alternatives necessary to permit a reasoned choice and to foster informed decision making and informed public participation (Section 15126[d][5]). Consideration of alternatives focuses on alternatives that can either eliminate significant adverse environmental impacts or reduce them to less-than-significant levels; alternatives considered in this context may include those that are more costly and those that do not fully attain the project objectives.

Similarly, the Council for Environmental Quality regulations for implementing NEPA (Section 1502.14) require all reasonable alternatives to be objectively evaluated in an EIS. Alternatives that cannot reasonably meet project objectives need be evaluated only to the extent necessary to allow a complete and objective evaluation and a fully informed decision by the lead agency. All alternatives recommended during the scoping process are addressed in this Stage 2 EIR/EIS.

In addition, to meet its basic project purpose, CCWD may need to discharge dredged or fill materials into waters of the United States. Section 404 of the Clean Water Act (Section 404) provides the statutory mechanism for the Corps to permit such discharges into waters of the United States. The Section 404(b)(1) Guidelines promulgated by EPA govern, in part, the issuance of permits by the Corps; compliance with the guidelines is mandatory before permit issuance by the Corps. Subpart B of the Section 404(b)(1) Guidelines states:

> No discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences (40 CFR 230.10[a]).

An alternative is practicable if it is available and capable of being accomplished after taking into consideration cost, existing technology, and logistics in light of overall project purposes (40 CFR 230.10[a]).

In compliance with the guidelines, CCWD has prepared an alternatives analysis to determine if practicable alternatives exist that do not involve the discharge of dredged or fill materials in waters of the United States (Contra Costa Water District 1991b). CCWD has used the Section 404(b)(1) alternatives analysis process to determine which of the possible alternatives for meeting its water quality and reliability objectives are appropriate to analyze in the Stage 2 EIR/EIS. A three-stage screening process is being conducted as part of the alternatives analysis. The alternatives analysis considered over 120 possible alternatives. The first two stages of screening have been completed. The Stage 2 EIR/EIS is an integral part of the third stage of screening. Those alternatives considered in this Stage 2 EIR/EIS, and thus in the third stage screening, are described below. Alternatives considered but eliminated in the first two stages of screening are generally described below under "Alternatives Considered but Not Included in Detailed Analysis".

PREFERRED ALTERNATIVE

CCWD has been conducting extensive environmental and engineering analyses over the last 5 years to configure a project that would satisfy its water quality, system reliability, cost, and environmental criteria. During preparation of this Stage 2 EIR/EIS, CCWD undertook a detailed comparison of the alternatives included in this EIR/EIS. This comparison included developing decision criteria to assess the alternatives. These criteria are as follows:

- the effects of the alternatives on wetlands, special-status plant and wildlife species, Delta fisheries, local and regional land uses, and Delta water quality;
- the ability to obtain various state and federal approvals needed to proceed with the alternatives;
- the ability of the alternatives to meet CCWD's water quality criterion;
- the ability of the alternatives to meet CCWD's system reliability criterion; and
- the ability of the alternatives to meet CCWD's cost criterion.

A comparison of the alternatives is presented toward the end of this chapter under "Summary Comparison of Alternatives". Based on these criteria, the additional information contained in this Stage 2 EIR/EIS, and CCWD's Section 404(b)(1) alternatives analysis, CCWD staff have preliminarily identified the Los Vaqueros Reservoir Alternative with the Rock Slough/Old River No. 5 intake as the least environmentally damaging practicable alternative under the Section 404(b)(1) Guidelines. This configuration is, therefore, the preferred alternative for this Stage 2 EIR/EIS.

NO-ACTION ALTERNATIVE

This alternative provides a baseline against which future operations of the project alternatives can be compared. Under the No-Action Alternative, projected CCWD water demands at buildout would be met by improving the Contra Costa Canal and CCWD system, but no steps would be taken to improve the quality or reliability of water delivered to CCWD customers. The planning assumptions used in developing the No-Action Alternative are the same as those described in Chapter 1.

Under the No-Action Alternative, lands in the Kellogg Creek watershed and its vicinity that CCWD has purchased would most likely be disposed of as surplus property. Although as a public agency CCWD is required to first offer surplus property to other public agencies, these agencies probably would have insufficient funding to acquire substantial portions of the excess property. The analysis in this EIR/EIS therefore assumes that the property CCWD is anticipated to dispose of under this alternative would revert to uses that existed before CCWD acquisition.

Many measures could be implemented to meet future CCWD demands. The system improvements described below are only one possible method of meeting future CCWD water demands. Because of uncertainties surrounding future system improvements, and because no detailed plans to make those improvements have been developed, site-specific environmental analyses of these improvements have not been conducted. Additional CEQA, and possibly NEPA, review would be required if and when specific design information for these improvements is available and such improvements are proposed by CCWD.

Contra Costa Canal Improvements Upstream of Pumping Plant No. 4

Contra Costa Canal Intake Channel

The canal intake channel is about 20,800 feet long and would need to be widened by about 20 feet to obtain a total minimum capacity of about 470 cfs. The estimated cost of expanding the intake channel is based on unit costs for unlined channel expansion (Table 2-1). The unit costs include clearing, excavation, embankment fill and compaction, rock excavation, access roads along the canal, and new siphons. The existing canal right-of-way is wide enough to allow widening of the canal by 20 feet.

Pumping Plants

Pumps at the pumping plants would need to be replaced and the capacity of each plant would need to be expanded to meet future demands. The existing pumps probably could not be incorporated because of their age and pumping characteristics. The cost estimate (Table 2-1) for expanding the pumping plants assumes complete replacement of the four existing pumping plants.

Contra Costa Canal Reach 3

Reach 3 of the canal is about 16,200 feet long and would need to be enlarged by raising the canal lining so that the water surface elevation could be increased about 1 foot.

Contra Costa Canal Improvements Downstream of Pumping Plant No. 4

Additional restrictions occur in the canal in reach 4 and possibly in reaches 9 and 10. CCWD could provide additional capacity downstream of pumping plant no. 4. However, because none of the alternatives considered in this EIR/EIS include improvements to CCWD's raw water supply system downstream (west) of pumping plant no. 4, specific plans have not been developed and it is therefore not possible to identify associated costs.

Table 2-1. Estimated Cost of Contra Costa Canal Improvements under the No-Action Alternative

Item	Cost (1988 dollars)
Enlarge intake channel (Reaches 1 and 2)	$3,943,000
Enlarge pumping plants	
No. 1 (2,000 horsepower)	2,740,000
No. 2 (2,000 horsepower)	2,740,000
No. 3 (2,000 horsepower)	2,740,000
No. 4 (3,950 horsepower)	4,673,000
Enlarge canal Reach 3	808,000[a]
Subtotal	$19,994,000
Contingencies (@ 35%)	6,998,000
Engineering, administration, and legal costs	5,398,000
Total estimated cost	$30,040,000

[a] Cost taken from canal facility plan (Blackmer pers. comm.) and adjusted to 1988 dollars.

LOS VAQUEROS RESERVOIR ALTERNATIVE

The Los Vaqueros Reservoir Alternative involves the construction of new supplemental intake facilities and appurtenant structures to deliver Delta water to a main storage facility with a capacity of 100,000 af at the Los Vaqueros Reservoir site (Figure 2-1) for later release to the Contra Costa Canal. These facilities would be designed to provide offstream storage of high-quality water for use during the seasonal intrusion of salinity into Delta waters. The reservoir would also provide storage for water that could be used during an emergency, such as a major levee failure or chemical spill, that made Delta water unusable for extended periods.

CCWD is evaluating seven possible alternate configurations of the Los Vaqueros Reservoir Alternative. The major reservoir facilities are identical in each configuration as is the design of many other project features. These configurations are differentiated primarily by intake locations in the Delta, associated water conveyance pipelines, and the location of the small regulating reservoir (transfer reservoir).

CCWD is considering six project configurations that use one of five new supplemental intake locations along Old River and one configuration that includes a supplemental intake on Clifton Court Forebay, which is operated by the SWP (Figure 2-2).

The area shown on the Kellogg Creek watershed boundary in Figure 2-1 has changed from the boundary shown in previous reports prepared for the Los Vaqueros Project. This change resulted from CCWD's review of the need to acquire the eastern portion of the previously identified area. That area, known as the Herdlyn watershed unit, is not tributary to either the Los Vaqueros Reservoir area or Kellogg Reservoir area as each is currently configured. CCWD has therefore decided to not acquire this area for project purposes. The phrase "Kellogg Creek watershed boundary" is used throughout this Stage 2 EIR/EIS to describe the portion of the true Kellogg Creek watershed upstream of the Kellogg dam site that CCWD is proposing to acquire.

A portion of the Herdyln area, however, may be acquired to mitigate loss of habitat for the San Joaquin kit fox (see Chapter 8, "Wildlife Resources"), and possibly to provide areas for wetland mitigation. In addition, CCWD is proposing, in conjunction with the East Bay Regional Park District (EBRPD), to acquire approximately 640 acres around the Vasco Caves area to ensure the protection of this important cultural resource area.

Project Operations

The Los Vaqueros Reservoir Alternative would be operated to meet the water quality and emergency storage goals of CCWD described in Chapter 1. Water would be diverted from the Delta to meet direct customer demand when Delta water quality meets CCWD's water quality goals. When diverting water to the Contra Costa Canal for direct use, CCWD would give preference to the intake (either the existing Rock Slough or new supplemental intake) that could deliver the best water quality. Neither intake would be sized sufficiently to meet CCWD's peak water demands. Therefore, during these peak periods when water quality was sufficient, both intakes would be used to supply the water necessary to meet system demands.

When an insufficient quantity of high-quality water is available from the intakes to meet CCWD's water demands and still achieve CCWD's water quality goals (65 mg/l chlorides and 50 mg/l sodium), water would be released from the reservoir and blended with supplies in the Contra Costa Canal to achieve CCWD's water quality goals.

The Los Vaqueros Reservoir would be filled only from the new supplemental intake. Reservoir filling would occur when surplus water of adequate quality is available in the Delta between November 1 and June

30. Water would be diverted to the reservoir only when chlorides were at a concentration of 50 mg/l or lower during that period. This diversion criterion is stricter in terms of water quality than CCWD's delivered water quality objectives for two reasons. First, water delivered from the reservoir to the Contra Costa Canal for blending must be of sufficiently high quality to blend with water diverted from the Delta, which could contain as much as 250 mg/l chlorides, and meet CCWD's goal of 65 mg/l chlorides. Second, evaporation occurring at the reservoir, particularly during summer, will increase the concentrations of water quality constituents, so water diverted to the reservoir must be of higher quality than would be needed strictly for delivery purposes.

The Los Vaqueros Reservoir would accommodate 100,000 af of water with a maximum allocation of 56,000 af of emergency storage; 30,000 af of water quality enhancement storage; 10,000 af of unused storage; and 4,000 af of evaporation storage.

The size of the reservoir was developed to provide an emergency supply equal to 90 days at the peak 3-month demand level at buildout (equivalent to 56,000 af of emergency storage) during wet and normal years, assuming customer cutbacks of 25% during the emergency period. During critical dry years or a series of such years, up to 26,000 af of this emergency storage may be used for water quality blending purposes in addition to the 30,000 af of water quality enhancement storage described above. Under these circumstances, an emergency supply equal to 30 days at the peak 1-month demand level at buildout (equivalent to 30,000 af of emergency storage) will be maintained in the reservoir for use during an emergency that rendered Delta water unusable.

An amount of water equivalent to the estimated Kellogg Creek inflow to the reservoir, up to 5 cfs, would be released to Kellogg Creek downstream of the dam. Additionally, CCWD would release a sufficient amount of water from the reservoir to maintain perennial pools and wetlands along Kellogg Creek within about 1 mile downstream of the Los Vaqueros dam site. Maintaining these areas may require releasing flows to Kellogg Creek in addition to those described above. Simulations indicate that Kellogg Creek has no measurable flow about 62% of the time and flows exceeding 5 cfs about 6% of the time.

Figure 2-3 compares projected average monthly diversions at buildout of the CCWD planning area under the Los Vaqueros Reservoir Alternative to average monthly diversions under both existing and future no-project conditions. Figure 2-4 schematically displays CCWD water system operations under the Los Vaqueros Reservoir Alternative.

Costs of the Los Vaqueros Reservoir Alternative

Detailed cost information for the Los Vaqueros Reservoir Alternative configurations is included in the Stage 2 EIR/EIS Technical Report (bound separately) and is summarized below in the "Summary Comparison of Alternatives" section.

Description of Common Facilities

Los Vaqueros Reservoir Facilities

The facilities described below are identical under all seven alternate configurations of the Los Vaqueros Reservoir Alternative.

Los Vaqueros Reservoir. The Los Vaqueros Reservoir (Figure 2-1) is the primary feature of the Los Vaqueros Reservoir Alternative, providing CCWD with offstream storage for water quality enhancement and emergency storage purposes. When full, the reservoir would cover approximately 1,460 acres.

Figure 2-1.
Los Vaqueros Reservoir and Appurtenant Facilities

LEGEND

- Los Vaqueros dam site
- Los Vaqueros Reservoir inundation area (elevation 472 feet)
- Los Vaqueros pipeline
- Spoil disposal area
- Kellogg Creek watershed boundary

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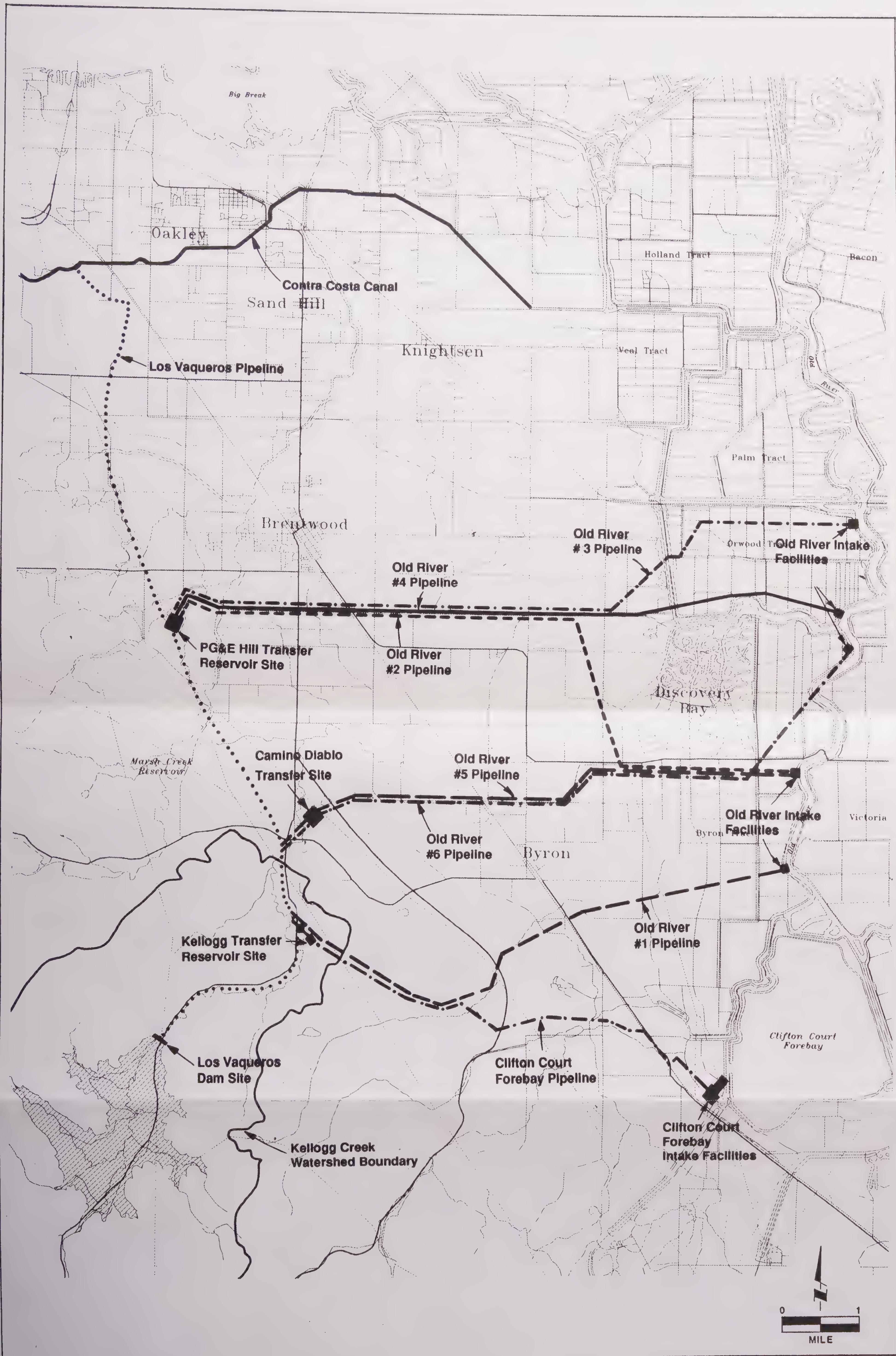


Figure 2-2. Los Vaqueros Reservoir Alternative - Alternate Project Configurations

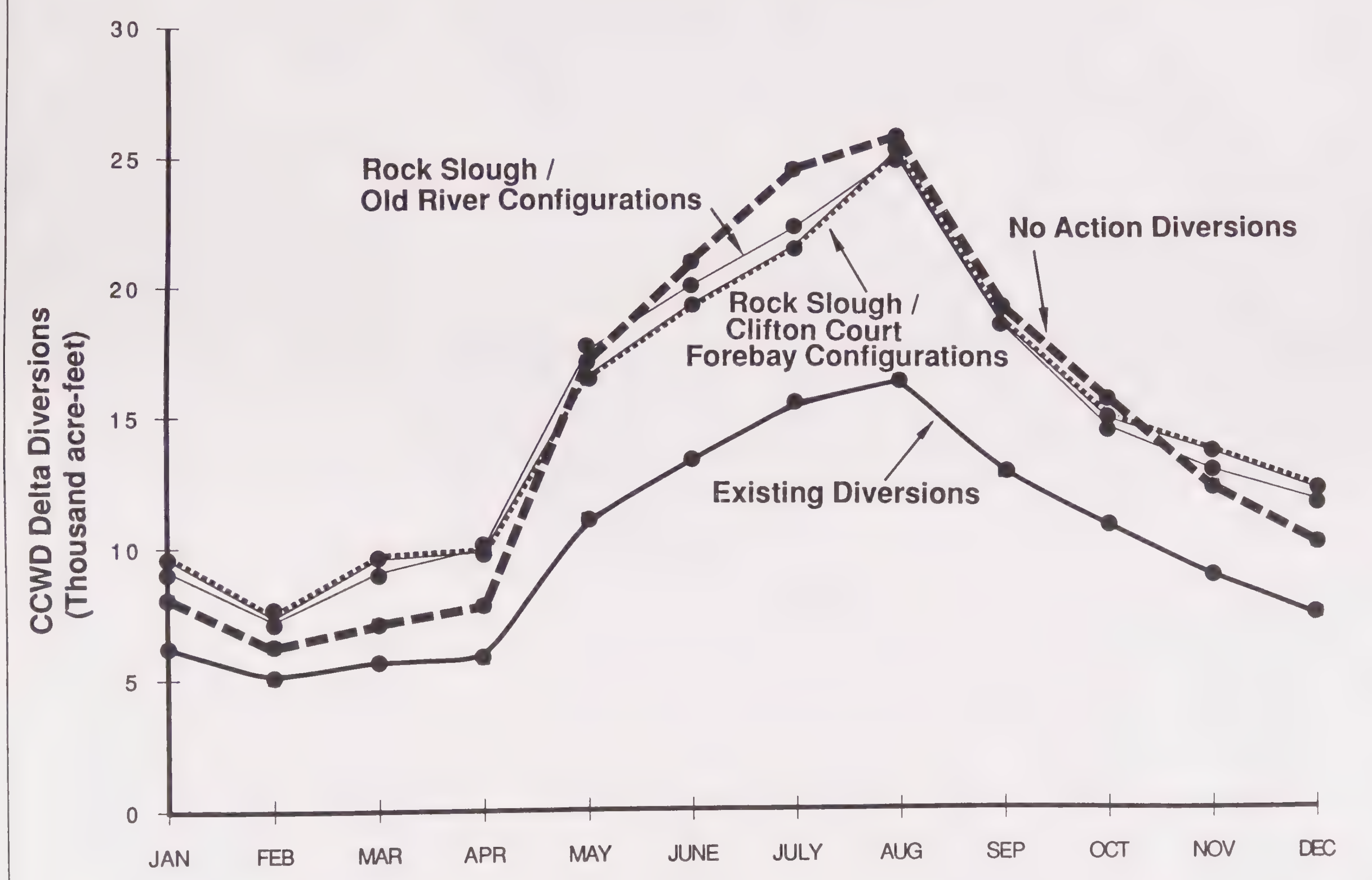


Figure 2-3. Los Vaqueros Reservoir Alternative Average Monthly Delta Diversions

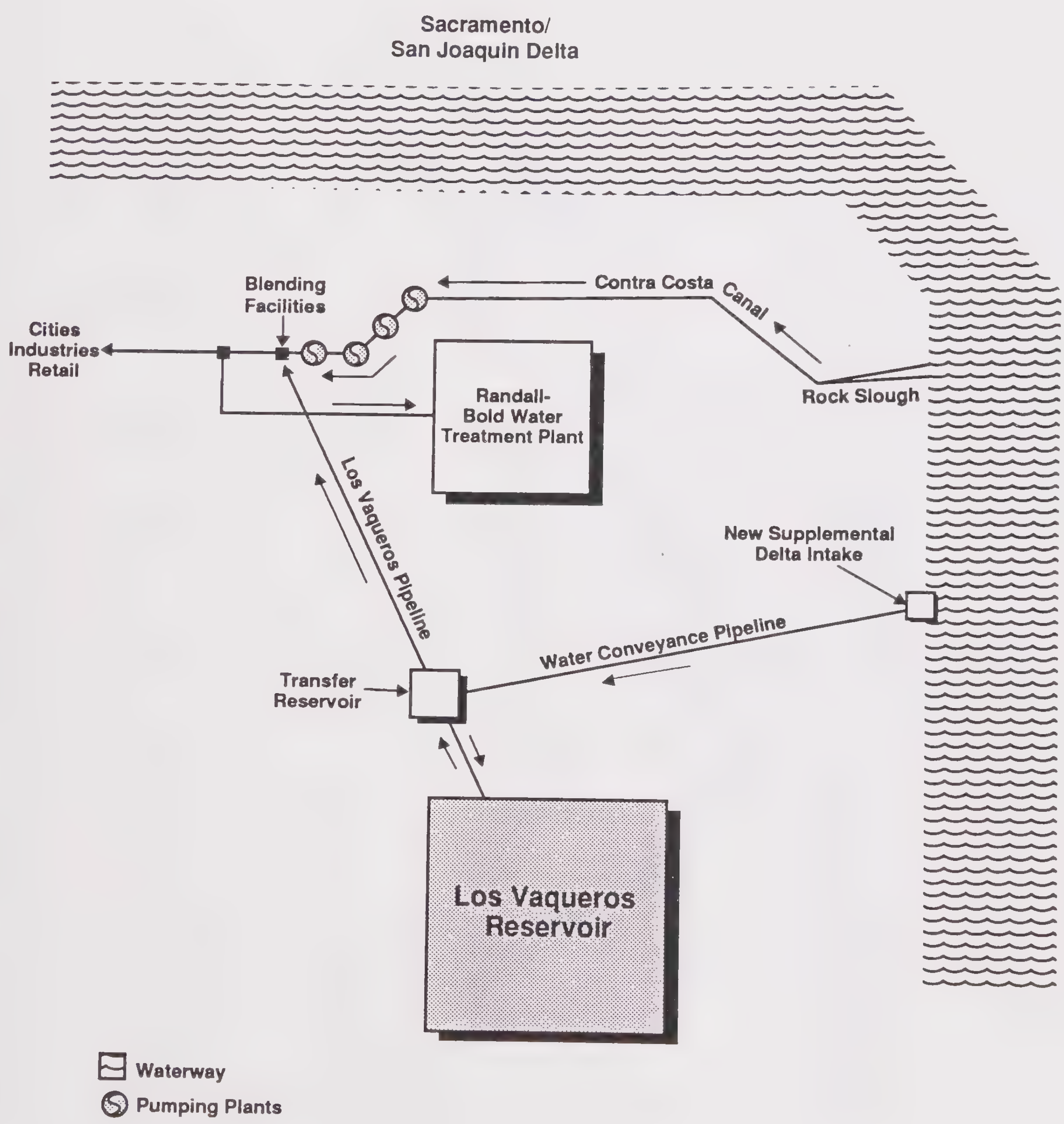


Figure 2-4. Flow Diagram of CCWD Water System with the Los Vaqueros Reservoir Alternative

Over time, the water level of the reservoir would fluctuate. Figure 2-5 shows the projected range of water level fluctuations in the Los Vaqueros Reservoir based on operations modeling of the 57-year period of record. During normal water years, the reservoir level would fluctuate from 5 to 7 feet below maximum pool, but could be drawn down as much as 50 feet during critical years.

Los Vaqueros Dam. The dam for the reservoir would be located on Kellogg Creek 7 miles south of Brentwood. The locations of the dam and reservoir under this alternative are illustrated in Figure 2-1. The dam would be an earthen embankment, approximately 192 feet high, zoned with clayey core materials, pervious filter and drain materials, and shell materials of mostly claystone or sandstone. A profile of the inlet/outlet facilities and a plan of the dam and other related facilities are shown in Figure 2-6.

Provisions will be included in the design of the dam to prevent uncontrolled seepage, piping, or erosion of materials during normal operation of the dam. Engineering design will also prevent uncontrolled leakage through the dam and consequent erosion of materials in the unlikely event that surface fault displacements occur in the dam foundation. The embankment, foundation, and abutments would be constructed to remain stable under all conditions of construction and operation, including rapid drawdown during emergency operation and drawdown during normal water release periods.

The dam would be constructed to have a minimum freeboard equal to 5% of the hydraulic height of the dam. Wave run-up has also been considered. The crest elevation of the dam has been established to account for potential settling of the dam and its foundation.

Spillway. The conceptually designed spillway would be a concrete-lined, chute-type facility with wide entrance channels and concrete and a riprap-lined stilling basin (Figure 2-6). The spillway has been provided even though without the spillway, the probable maximum flood event could be stored within the reservoir. Flow from the spillway would be discharged into Kellogg Creek near the downstream toe of the dam.

Inlet/Outlet Works. The inlet/outlet works (Figure 2-6) would enable water to be released from near the bottom of the reservoir, allowing nearly complete drainage in the event of an emergency, and from two midlevel ports in the reservoir to satisfy water quality blending needs during normal operation and enable water to be pumped back into the reservoir during periods when supplies are available for storage.

In compliance with DSOD regulations, the inlet/outlet facilities would have sufficient capacity to enable drainage of the water stored within the upper 10% of the hydraulic height of the dam within 7-10 days. Additionally, the low-level outlet facilities would have sufficient capacity to enable drainage of the reservoir to dead storage within 90-120 days.

Neroly Blending Facilities

The Neroly blending facilities would blend water from either storage in the Los Vaqueros Reservoir or water diverted directly from Old River or Clifton Court Forebay with Contra Costa Canal water diverted from Rock Slough. This blending is necessary to provide identical water quality to CCWD customers. These facilities would be located at the junction of the Los Vaqueros pipeline and the Contra Costa Canal. This junction occurs immediately downstream of pumping plant no. 4.

Los Vaqueros Reservoir water, or water diverted from the new supplemental intake, would flow from the 96-inch-diameter Los Vaqueros pipeline, split into two 72-inch-diameter branches, and flow into the Contra Costa Canal where it would blend with water diverted at Rock Slough. As this water continues downstream, it would be blended by a series of precast baffle walls. Blended water would then be diverted to the Randall-Bold Water Treatment Plant grit basin through a new canal diversion structure downstream of the blending facilities and would also continue downstream in the Contra Costa Canal for delivery to other CCWD customers.

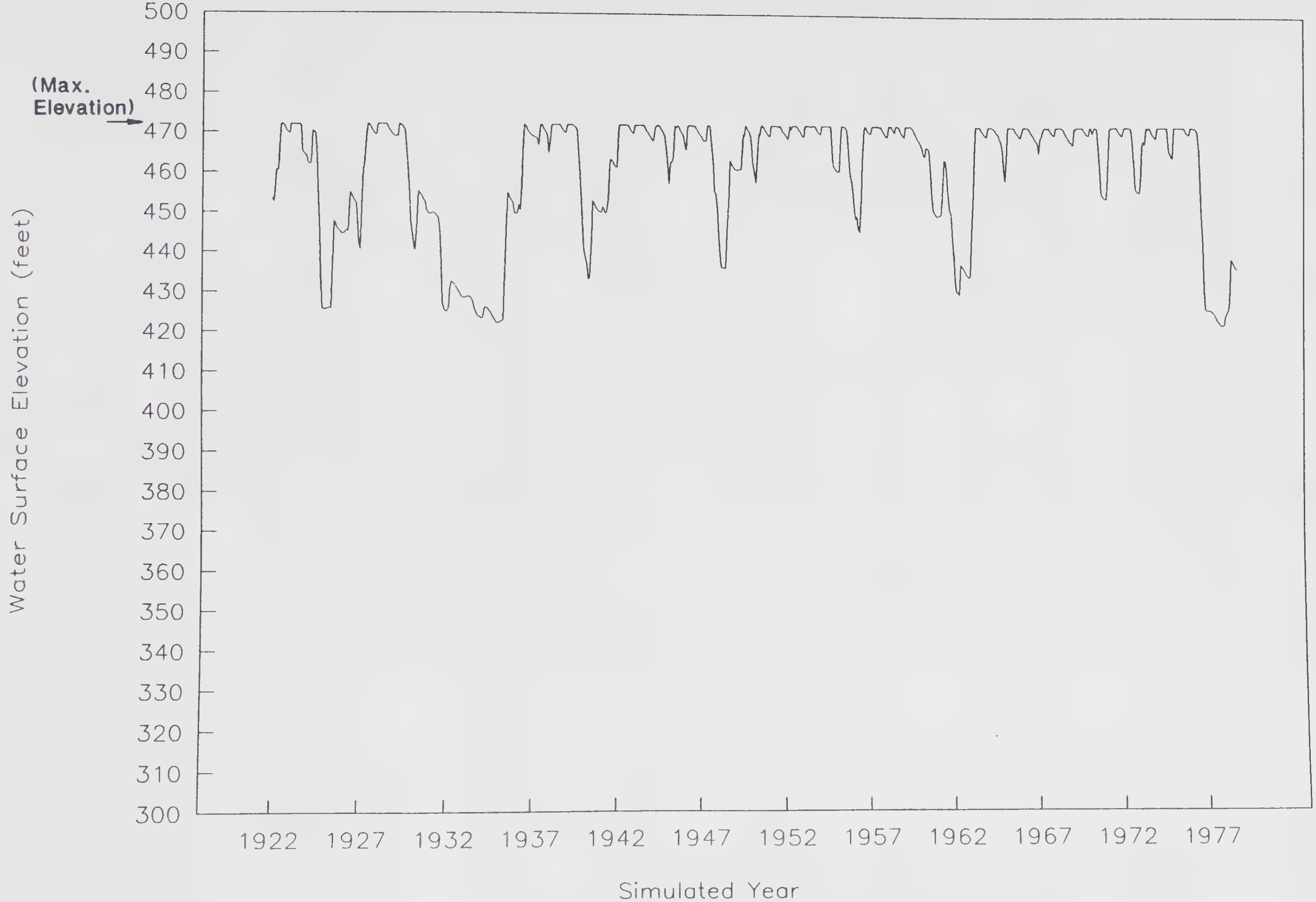


Figure 2–5. Simulated Los Vaqueros Reservoir Water Surface Elevations, Using 1922–1978 Hydrologic Data

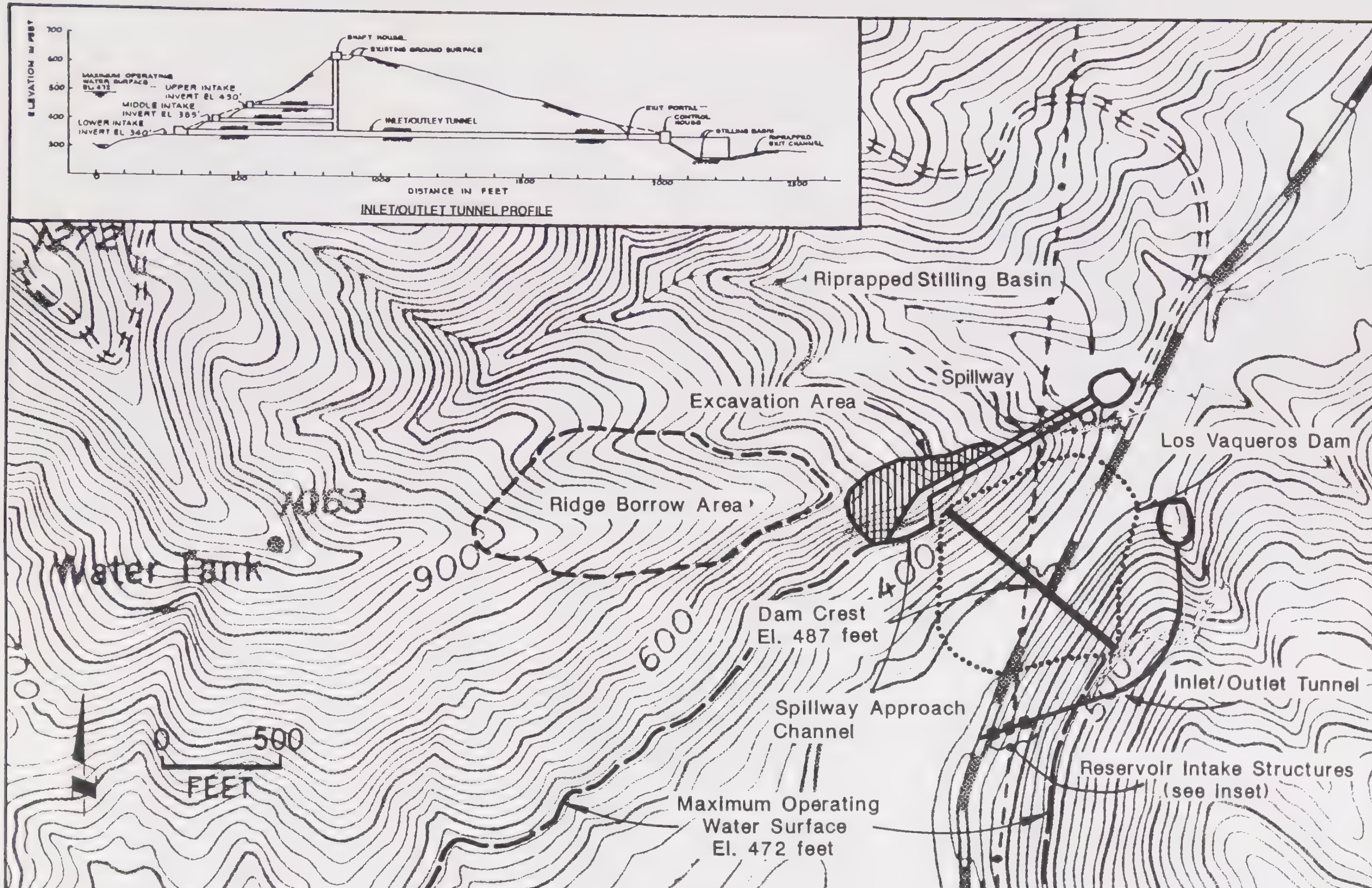


Figure 2-6. Los Vaqueros Dam Site and Vicinity

Source: Woodward-Clyde Consultants 1988, Blackmer pers. comm.

Los Vaqueros Pipeline

Although the Los Vaqueros pipeline is a single pipeline, the southern section of the pipeline can be distinguished by its ability to function under two-way operation between the transfer reservoir and the Los Vaqueros Reservoir. Two-way operation of this pipeline section would be controlled at the transfer reservoir site. The 96-inch-diameter pipeline would be designed to deliver up to 200 cfs of water from the transfer pumping plant to the Los Vaqueros Reservoir and to return water during normal operations at up to 400 cfs by gravity flow from the Los Vaqueros Reservoir to the transfer reservoir and then to the Contra Costa Canal.

The Los Vaqueros pipeline (Figure 2-2) is a 12-mile-long facility that would run from the Neroly blending facilities at the Contra Costa Canal southeast for approximately 0.6 mile, where the pipeline generally follows the alignment of the Lindsey Detention Basin inflow channel for approximately 0.8 mile. The pipeline would then run south for approximately 1.2 miles, crossing Lone Tree Way, the Mokelumne Aqueduct, and Sand Creek. The pipeline would then turn south-southeast for approximately 4.4 miles, crossing San Jose Avenue, Balfour Road, Concord Avenue, Marsh Creek Road, and Camino Diablo Road. From there, the pipeline would run south along the west side of Vasco Road for approximately 1 mile, then cross to the east side of Vasco Road. From this point, the pipeline would run to the main dam of the Los Vaqueros Reservoir, remaining to the east of Vasco Road, within 300 feet of the roadway.

Power Supply Facilities

The power supply for the transfer reservoir facilities would be obtained by tying into an existing northwest- to southeast-oriented 230,000-volt (230-kV) Pacific Gas and Electric Company (PG&E) transmission line located near all three transfer sites under consideration. The power supply for the alternate intake pumping plants under consideration would be obtained by tying into a Western Area Power Administration (WAPA) 69-kV or 230-kV transmission line. These two northwest- to southeast-oriented transmission lines are located several miles west of Old River and immediately adjacent to Clifton Court Forebay.

The new electric transmission lines would have the same capacity as the existing WAPA or PG&E lines and would convey electricity to substations that would be constructed adjacent to the transfer and intake facilities. The new substation site would include approximately 1 acre each. If used, the 69-kV transmission lines would be pole mounted; the 230-kV transmission lines would be supported on steel towers.

The electric transmission lines would generally be placed within existing rights-of-way and along newly constructed pipeline alignments. Additional information on the location of these transmission lines is provided in later discussions of the alternate project configurations.

Conceptual Recreation Plan

The Los Vaqueros Draft Recreation Plan (Jones & Stokes Associates 1991d) generally outlines the approach to public access and provision of recreation opportunities in the portion of the Kellogg Creek watershed that is being acquired by CCWD. The Los Vaqueros draft recreation plan presents the draft plan goals, objectives, and policies; discusses the existing regional recreation context and study area resource sensitivities (including development guidelines); describes the major recreation concepts, access and circulation, use areas and facilities, and design capacity; outlines an interpretation and education plan; identifies other related management plans; and generally describes development phasing and costs. The plan is available for review at CCWD's offices. The following discussion summarizes that report.

Purpose and Concept

The purpose of the plan is to present a general strategy for public use of the Kellogg Creek watershed in accordance with the primary and secondary project objectives identified in CCWD Resolutions 88-45 and 88-46.

The plan concept comprises seven interrelated themes that are the guiding components of the Los Vaqueros recreation concept:

- **Water quality:** The primary objective of the Los Vaqueros Project is to improve the quality and reliability of CCWD's water supply. All other watershed activities are secondary to the goals of maintaining water quality and providing system reliability.

- **Multiple use:** A wide variety of outdoor recreational pursuits, both active and passive, will be supported within the watershed.

- **Resource stewardship and energy efficiency:** Recreation features are designed to minimize the effects of public use on existing land uses, biological resources, landscape diversity, and unique cultural resources. Educational displays related to energy and water conservation will be incorporated into appropriate public access features.

- **Remoteness and tranquility:** The Los Vaqueros recreation concept emphasizes the watershed's natural seclusion and the calming influence of the reservoir's waters. Maintaining these qualities is primarily a function of controlling access and circulation, limiting motorized vehicle use, and dispersing public use.

- **Education and research:** The plan incorporates opportunities for educational and scientific research programs and public participation in resource conservation, social science, and other management program studies.

- **Controlled access and deemphasized automobile use:** General public vehicular access is limited to the perimeter of the watershed. During moderate- to high-use periods, visitors will be able to reach the reservoir and other public amenities via a vehicular tram ride or on foot. The vehicular tram route will serve as a multiple-use trail for general public access, operations and maintenance vehicles, emergency vehicles, and special access needs.

- **Management flexibility:** The plan encourages flexible watershed management that is responsive to a variety of use scenarios. Public access is controlled by limiting access to specific areas using control gates, fencing, and signs and by allowing tram stops only in appropriate use areas. Vehicular tram use would occur during moderate- to high-use periods. Limited vehicular access could be allowed for special needs or during low-use periods.

The plan provides a variety of recreation opportunities that can be incorporated into a flexible management system. The plan design emphasizes avoiding or minimizing the effects of recreation on reservoir water quality, adjacent watershed land uses, and biological and cultural resources.

Planning guidelines are identified that would minimize or eliminate the adverse effects of recreation on most environmental resources. The guidelines that have been incorporated into the recreation planning effort are included in the Stage 2 EIR/EIS Technical Report (bound separately).

Public Access and Use Areas

Primary and secondary access to and within the watershed would be provided by 55 miles of roadway and trail corridors (Figure 2-7). Multiple-use trails are provided throughout the watershed for a tram system, hiking and pedestrian use, shoreline fishing access, bicyclists, and equestrians. The trail system is also designed to connect to existing or proposed regional trail corridors.

Table 2-2 and Figure 2-7 outline facilities and locations proposed for the recreation program. Table 2-2 also shows the program facilities that would be initially provided when the recreation area is opened to the public, and long-term facility development.

Management Facilities

Management of the watershed includes provisions for a headquarters and administrative center, maintenance and storage areas, emergency access routes and helicopter landing areas, a gate and fencing system, and ranger residences.

Facility Capacity

The estimated peak day-use capacity of recreation facilities at buildout of the recreation plan would range from 5,200 people to 9,500 people. Annual recreation use is anticipated to range from 1.0 to 1.8 million people.

Costs and Revenue Sources

Development costs for implementing the initial phase of the recreation program is approximately $5-6.6 million. Overall program development costs in addition to the initial facilities are approximately $28.5-34.2 million. Annual operating costs at project buildout would be approximately $2.3-2.7 million. To date, CCWD has identified funding for only the initial portion of Phase I amounting to $6.6 million.

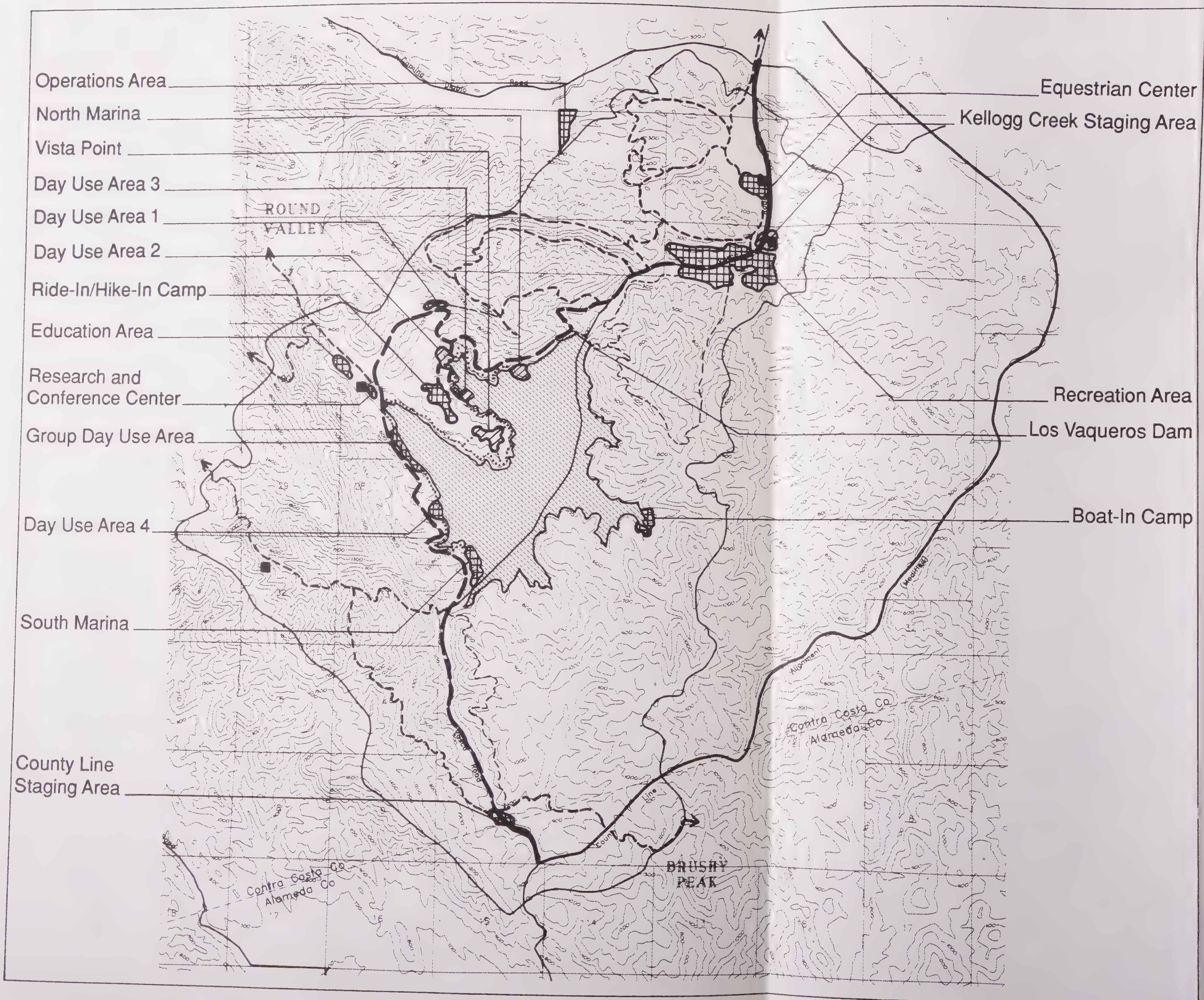
Possible revenue sources for development of the recreation program include CCWD Proposition W revenue bonds, grants from agencies and private organizations, additional CCWD bond funding, and user fees. Initial recreation development (facilities that would be provided when the Kellogg Creek watershed is open to the public) would be financed from revenue bonds (Proposition W) and grants. User fees are expected to offset operation and maintenance costs.

Vasco Road and Utility Relocations

Vasco Road (an important regional roadway), one 230-kV PG&E electric transmission line, three natural gas pipelines, and two high-pressure petroleum pipelines would need to be relocated under this alternative. The relocation alignments for each facility are shown in Figure 2-8. As described in Chapter 1 under "Staged EIR Process", CCWD has prepared a separate Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990), which was certified by CCWD in September 1990.

The Vasco Road and Utility Relocation Project EIR describes alternatives for the various road and utility realignments in detail and discusses their potential environmental impacts (Jones & Stokes Associates 1990). The entire Vasco Road and Utility Relocation Project EIR is hereby incorporated into this Stage 2 EIR/EIS by reference. Copies of the Vasco Road and Utility Relocation Project EIR are available for review at CCWD's office in Concord, California.

Figure 2-7.
Los Vaqueros Conceptual Recreation Plan Use Areas and Facilities



LEGEND

Los Vaqueros Reservoir
Access road
Developed use area
Initial facilities
Long-term facilities
Trail corridors
Tram route/multiple-use trail
Fire trail
Riding & hiking trail
Hiking & fishing trail
Potential ranger residence

This drawing is conceptual and for planning purposes only. Program information, scale, location of areas, and other information shown are subject to field evaluation and modification.

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Table 2-2. Recreation Use Areas and Facilities

Area[a]	Initial Facilities	Long-Term Facilities
Operations area		Maintenance and storage area
Kellogg Creek staging area	Control station; parking (250 cars); tram station area; trail access	Parking (1,500 cars)
Equestrian center		Staging area and trail access; horse rental; horsemanship programs; riding rings; boarding stables
Recreation area		Headquarters and ranger residence; visitor and nature center, including outdoor classroom, interpretive trails, and vegetation enhancement area (for school programs); family and large group picnic sites (up to 250 people); swimming facilities, including small lake (3 acres) and beach, bath house, and sunbathing area; open play areas; playgrounds (near family use areas); campground (120 units with automobile access); food supplies
Watershed trails	All-weather multiple-use (northern portion of shuttle route) hiking and fishing trails (approximately 4.5 miles)	Multiple use area (approximately 51.3 miles)
County line staging area	Parking (250 cars)	Parking (500 cars); control and fee station; tram station area; maintenance and storage area; trail access; equestrian staging area; nearby ranger residence
Los Vaqueros Dam		Interpretive station; family picnic sites
North Marina	Marina (100 low-horsepower motor-boats); bait and tackle shop; food supplies	
Day use area 1		Family and small group picnic sites (50 people); open play fields; trail access
Day use area 2	Family and small group (50 people) picnic sites; trail and fishing access	
Day use area 3	Family picnic sites; fishing pier; trail and fishing access	Bait and tackle shop; food supplies

Table 2-2. Continued

Area[a]	Initial Facilities	Long-Term Facilities
Ride-in/hike-in camp		Walk- or ride-in camp (15 sites); small group environmental camp (two sites, 25-person capacity each); trail and fishing access
Vista Point	Family picnic sites; education displays; trail and fishing access; amateur astronomy area	
Research and conference center		Indoor meeting room (60 people); exhibit room; office and storage; outdoor meeting area (60 people); overnight accommodations (30 people); ranger residence
Education area		Outdoor classroom; vegetation enhancement area (for school programs)
Group day use area		Group picnic sites
Day use area 4		Family picnic sites
South Marina		Marina (100 low-horsepower motorboats); boat launch (administrative use only); bait and tackle shop; family and small group picnic sites; food supplies
Boat-in camp		Boat-in environmental camp (15 sites); floating dock

[a] Each use area would have drinking water, sanitary facilities, and emergency telephones.

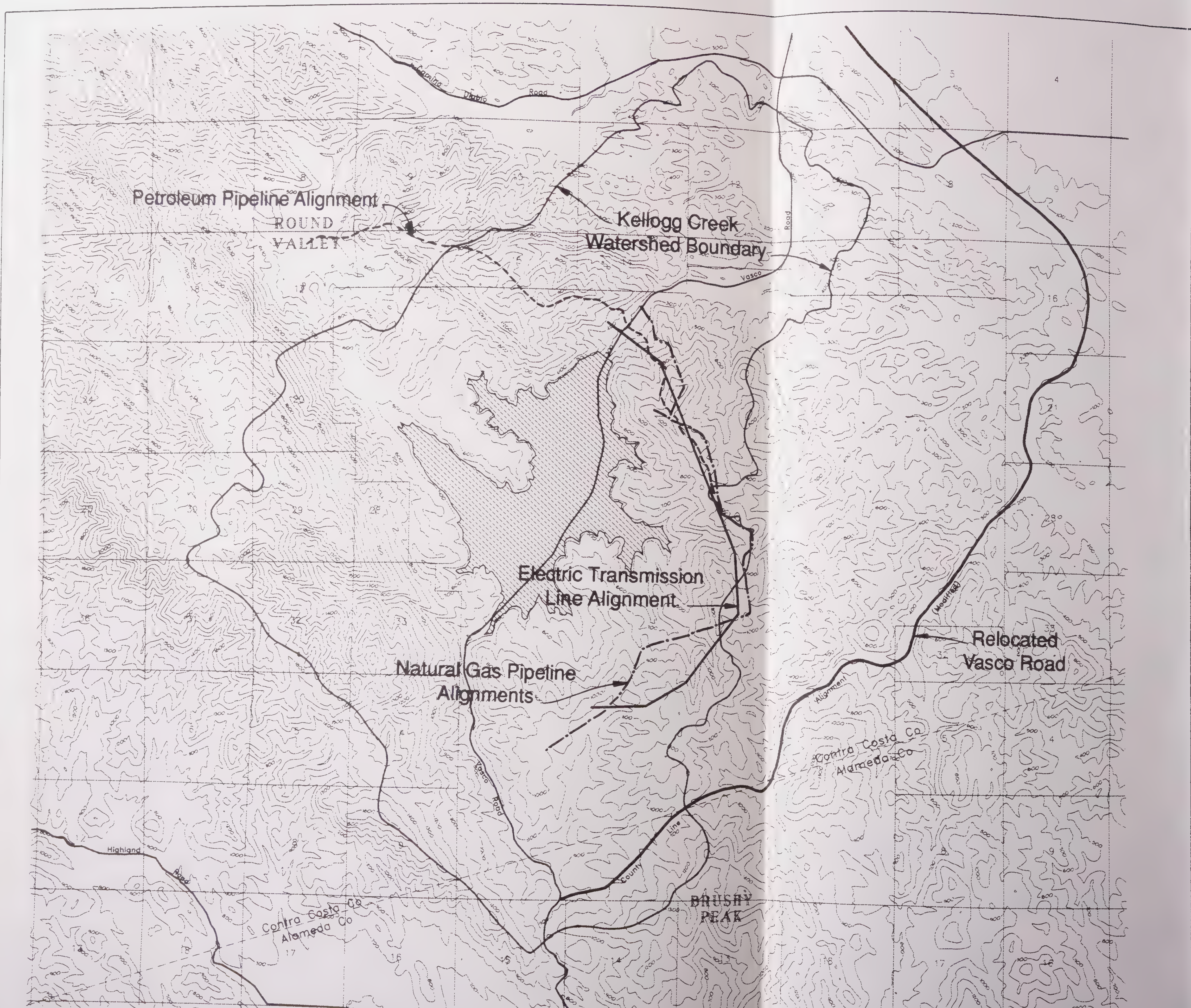


Figure 2-8.
Vasco Road and Utility Relocation Alignments under the Los Vaqueros Reservoir Alternative

As a result of that EIR, mitigation measures were adopted by CCWD that reduced almost all impacts to less-than-significant levels. Summaries of the environmental analyses conducted for the Vasco Road and utility relocation project are included in each pertinent topic area in subsequent chapters of this Stage 2 EIR/EIS. Impacts associated with the road and utility relocations and measures adopted by CCWD to minimize these impacts are also described.

Other Los Vaqueros Reservoir Alternative Facilities

As described above, seven alternate project configurations are being considered for the Los Vaqueros Reservoir Alternative. Many additional facilities, however, are identical except for their location. These common facilities are discussed immediately below, and the specific location of each of these facilities is discussed below under "Alternate Project Configurations".

Supplemental Intake Facilities. The Los Vaqueros Reservoir Alternative involves the operation of new supplemental intake facilities in combination with those existing at Rock Slough. The new intake facilities would be designed to divert Delta water supplies to a transfer reservoir, where the water could be pumped to the Los Vaqueros Reservoir and/or released to the Contra Costa Canal for blending purposes. The locations of the alternate supplemental intake facilities under consideration are shown in Figure 2-2.

The supplemental intake facilities would include an intake channel, fish screening facilities, and a pumping plant, all sized to accommodate up to 250 cfs. Fish screening facilities would include a trash rack and trash rack cleaners upstream of 14 screen bays. A control gate behind each screen would control the flow through each screen bay and ensure an even distribution of flow between the screen bays. The design of these supplemental intake facilities is essentially identical. The intake sites would include approximately 7 acres. Additional acreage may be required for construction activities and spoil disposal. A preliminary fish screen design is included in Appendix A.

Conveyance Facilities. The supplemental intake pipeline would be designed to convey water supplies from the intake facilities to the transfer reservoir facilities. The pipeline would be approximately 90 inches in diameter and would be capable of delivering water at a rate of up to 250 cfs.

Transfer Reservoir and Pumping Plant. The transfer reservoir would simplify the control system required to route flows from the supplemental intake facilities to the Los Vaqueros Reservoir, to the Contra Costa Canal, or to both delivery points at the same time. The transfer reservoir would also provide a relatively stable hydraulic gradient for the new intake facilities, allowing greater average efficiency in pumping operations. The locations of the three alternate transfer reservoir sites associated with the various alternate project configurations under consideration are shown in Figure 2-2.

The transfer reservoir pumping plant facilities would include a power substation; flow meters; isolation valves; a pressure reduction station; access roads; hydropneumatic tanks for surge suppression; a pipe cleaning retrieval structure; and a pumping plant, which would consist of six parallel electric pumping units capable of lifting project water at up to 200 cfs from the transfer reservoir to the main reservoir. The transfer reservoir facilities would be located on an approximately 10-acre site with all construction activities expected to be contained on the site.

Because the normal operating water level in the Los Vaqueros Reservoir would range in elevation from 472 to about 420 feet, and because of the operation patterns of this alternative, the hydraulic head on the transfer pumps would vary substantially and all six pumps would not operate at all times. Because the pumps would be operated only to fill the Los Vaqueros Reservoir, the pumping plant would only be used for a few months in any given year.

Alternate Project Configurations

The Los Vaqueros Reservoir Alternative would involve siting the proposed intake facilities at one of five locations on Old River or at Clifton Court Forebay. The location of the transfer reservoir and the alignments of the conveyance facilities would vary according to the location of the intake facilities.

Rock Slough/Old River No. 1 Configuration

Old River No. 1 Intake Facilities. Under this configuration, the new supplemental Old River intake facilities would be located approximately 1.5 miles south of State Route (SR) 4 along Old River. The location of the Old River No. 1 intake facilities and conveyance pipeline is illustrated in Figure 2-9. The intake pumping plant would be designed with about 10,000 horsepower.

An electric transmission line would extend from the substation planned for the site of the new Old River No. 1 intake facilities to one of two existing WAPA transmission lines (69 kV or 230 kV) located approximately 1.5 miles west of the new facilities (Figure 2-9). The new electric transmission line would be constructed adjacent to conveyance facilities that would be constructed under this configuration.

Transfer Reservoir and Pumping Plant. Implementation of Rock Slough/Old River No. 1 configuration would include the construction of an approximately 10-af reinforced concrete transfer reservoir, which would be located in the Kellogg Creek watershed (Figure 2-9).

The transfer reservoir pumping plant and associated facilities would be designed as indicated above under "Description of Common Facilities". The pumping plant would be designed with 8,000-9,000 horsepower. Electricity would be provided to the transfer reservoir and pumping plant by constructing a short, 230-kV PG&E transmission line to a new substation that would be located at the transfer reservoir site.

Old River No. 1 Pipeline. This configuration would require a new 7.1-mile-long pipeline to deliver project water from the Old River No. 1 intake to the transfer reservoir in the Kellogg Creek watershed.

The Old River No. 1 pipeline would run west-southwest for approximately 2.7 miles, crossing a PG&E powerline right-of-way and the Southern Pacific Railroad right-of-way. Beyond this point, the pipeline would wind into the Kellogg Creek watershed, passing approximately 1 mile east of Byron Hot Springs.

Rock Slough/Old River No. 2 Configuration

Old River No. 2 Intake Facilities. Under this configuration, the new supplemental Old River intake facilities would be located approximately 1,000 feet south of SR 4 along Old River. Figure 2-10 illustrates the location of the Old River No. 2 intake facilities. The intake pumping plant would be designed with 9,000 horsepower.

To supply electricity to the intake site, a transmission line would connect a new substation at the intake facilities to one of two WAPA transmission lines (69 kV or 230 kV) approximately 2 miles west of the Old River No. 2 intake site (Figure 2-10). The new electric transmission line would be constructed along the Old River No. 2 pipeline alignment.

Transfer Reservoir and Pumping Plant. This project configuration includes constructing an approximately 10-af reinforced concrete transfer reservoir at the PG&E Hill site (Figure 2-10). A transfer reservoir pumping plant would be constructed as discussed above under "Description of Common Facilities". Electricity would be provided to the transfer reservoir and pumping plant by constructing a short, 230-kV transmission line connecting the new substation at the transfer site to the existing 230-kV PG&E transmission line adjacent to the site (Figure 2-10).

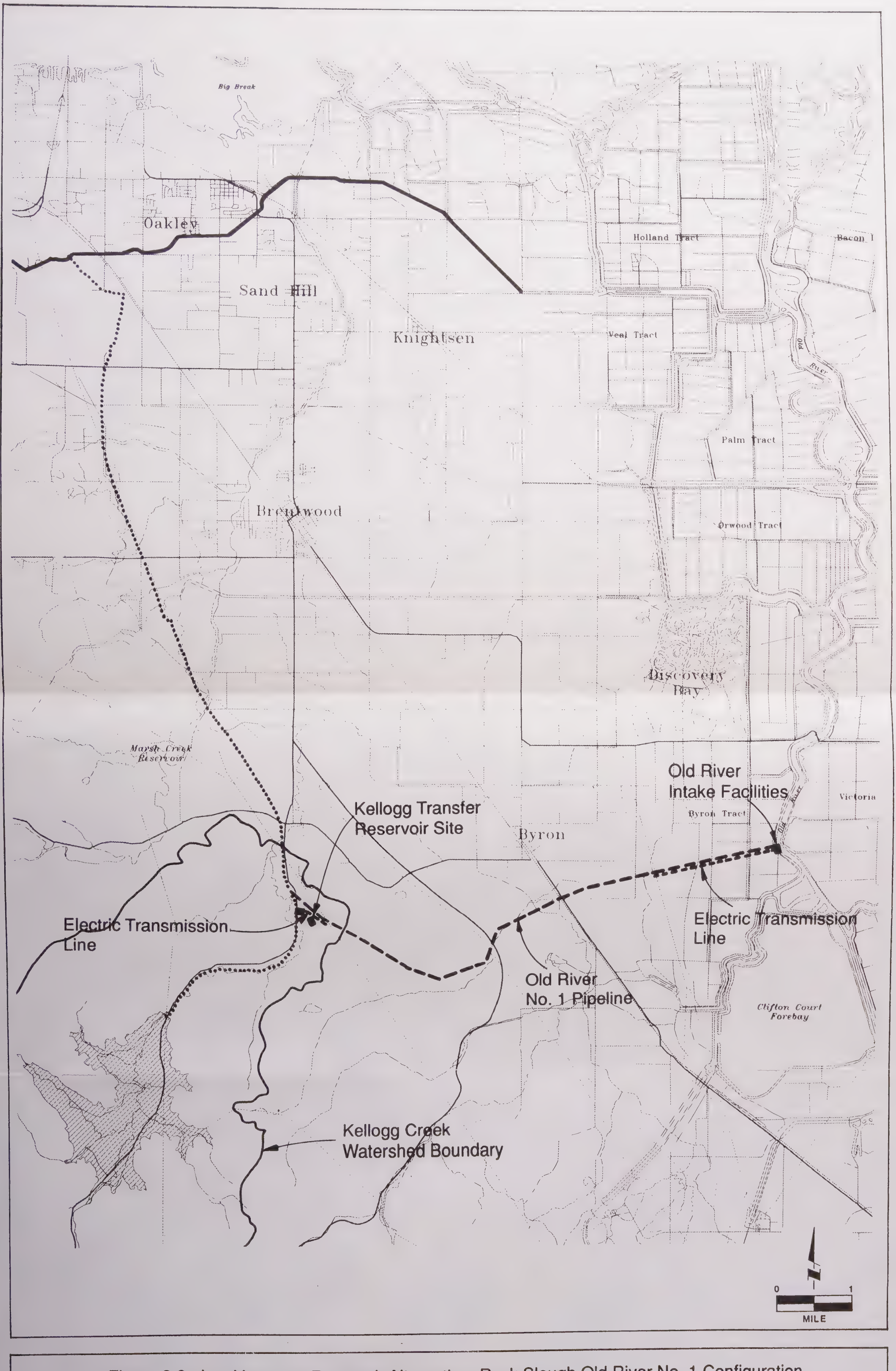


Figure 2-9. Los Vaqueros Reservoir Alternative - Rock Slough Old River No. 1 Configuration

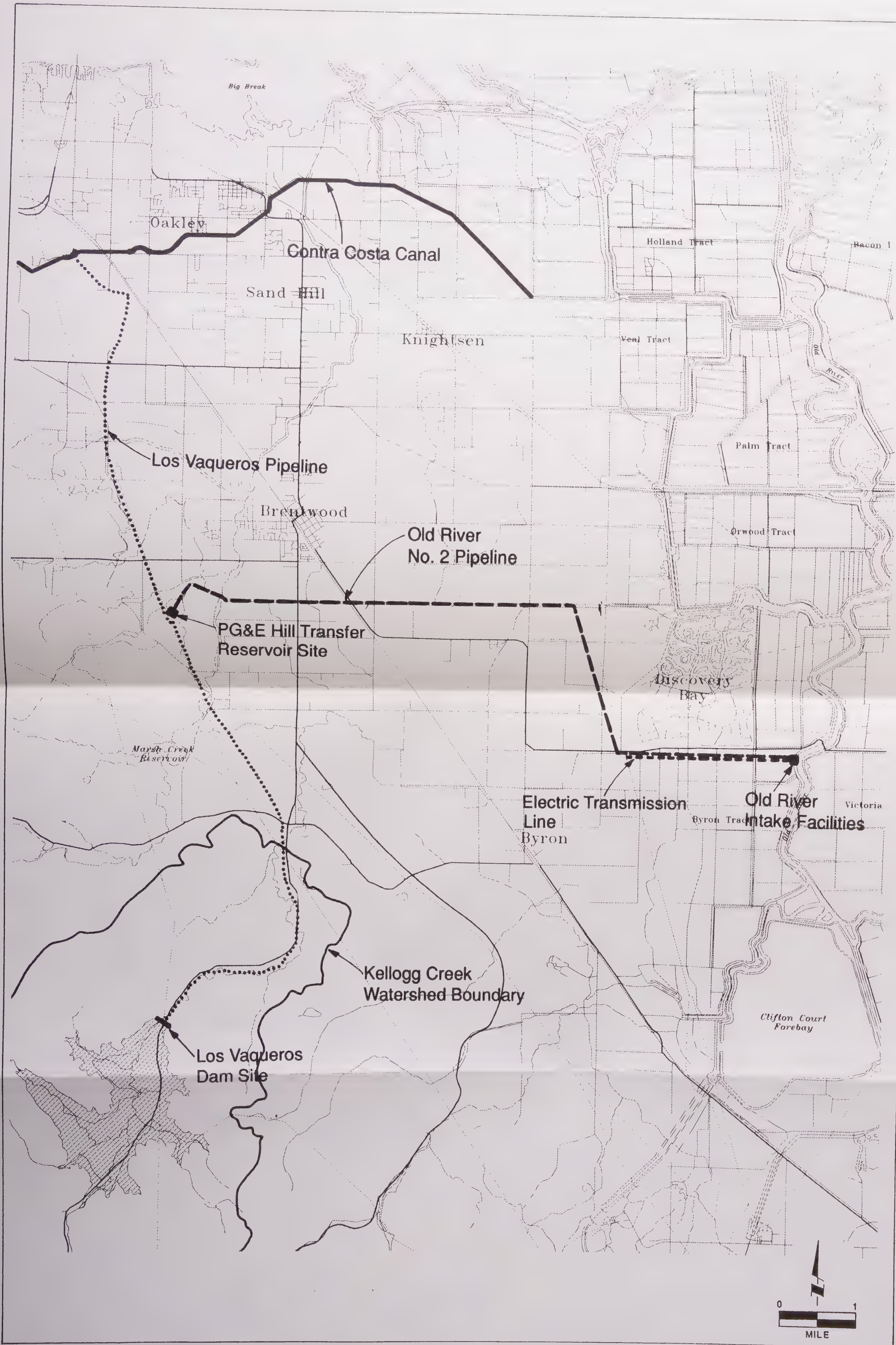


Figure 2-10. Los Vaqueros Reservoir Alternative - Rock Slough/Old River No. 2 Configuration

The transfer reservoir pumping plant and associated facilities would also be designed as indicated above under "Description of Common Facilities". The pumping plant would be designed with 9,000 horsepower.

Old River No. 2 Pipeline. This project configuration would include a new, 10-mile-long pipeline to deliver water from the Old River No. 2 intake to the transfer reservoir located at the PG&E Hill site. This pipeline would run west from the Old River intake facilities near SR 4 before turning northwest along the western side of a PG&E electric transmission line alignment. The pipeline would then turn west and continue along a 5.5-mile stretch of the East Contra Costa Irrigation District (ECCID) canal right-of-way to the PG&E Hill transfer reservoir site. Figure 2-10 shows the alignment of the Old River No. 2 pipeline.

Rock Slough/Old River No. 3 Configuration

Old River No. 3 Intake Facilities. Under this configuration, the new supplemental Old River intake facilities would be located near the northeastern corner of Orwood Tract, approximately 1,000 feet south of the Mokelumne Aqueduct. The location for these facilities is shown in Figure 2-11.

To supply electricity to the Old River No. 3 intake facilities, a transmission line would be constructed connecting the new intake facilities to one of two existing WAPA transmission lines (69 kV or 230 kV) approximately 3 miles west of the new facilities (Figure 2-11). The new transmission line would be constructed along the Old River No. 3 pipeline alignment.

Transfer Reservoir and Reservoir Pumping Plant. The transfer reservoir, pumping plant, and electric transmission lines under this configuration would be identical to that described under "Rock Slough/Old River No. 2 Configuration".

Old River No. 3 Pipeline. This pipeline would run approximately 2 miles west from the intake facilities on Old River at Orwood Tract, turn southwest, and cross the Werner-Dredger Cut approximately 3,000 feet south of the Mokelumne Aqueduct. The pipeline would continue southwest for approximately 1 mile before turning west along the ECCID main canal. As with the Old River No. 2 pipeline, the Old River No. 3 pipeline would then continue west along the ECCID canal alignment to the PG&E Hill transfer reservoir site. Figure 2-11 illustrates the Old River No. 3 pipeline alignment.

Rock Slough/Old River No. 4 Configuration

Under this configuration, the Los Vaqueros pipeline, the transfer reservoir and pumping plant, and electric transmission lines to the transfer reservoir would be as described above under "Rock Slough/Old River No. 2 Configuration". The location of the Old River intake facilities and corresponding pipelines is discussed below.

Old River No. 4 Intake Facilities. Under this configuration, the new supplemental Old River intake facilities would be constructed near the southeastern tip of Orwood Tract, on the west bank of Old River. The location of the Old River intake facilities is indicated in Figure 2-12. The intake pumping plant would be designed with 8,000 horsepower.

To supply electricity to the Old River No. 4 intake facilities, a new transmission line would connect a new substation at the intake site to one of two existing WAPA transmission lines (69 kV or 230 kV) approximately 3 miles west of the new intake facilities. The transmission line would be constructed along the alignment of the Old River No. 4 pipeline (Figure 2-12).

Old River No. 4 Pipeline. The Old River No. 4 pipeline (Figure 2-12) would run primarily west from the proposed Old River intake facilities near the southeastern corner of Orwood Tract, skirting north of Indian

Slough. The pipeline would then run across the Werner-Dredger Cut north of Indian Slough, continuing on to intersect the ECCID right-of-way. The pipeline would continue partially within the 200-foot ECCID right-of-way to the PG&E Hill transfer reservoir site.

Rock Slough/Old River No. 5 Configuration

Under this configuration, the new supplemental Old River intake facilities and associated electric transmission lines would be identical to those described above under "Rock Slough/Old River No. 2 Configuration". Because the location of the transfer reservoir facilities and aspects of the Los Vaqueros pipeline are different, these facilities are described below. Figure 2-13 shows the location of facilities under this configuration.

Transfer Reservoir and Pumping Plant. The transfer reservoir under the Rock Slough/Old River No. 5 configuration would be located at the Camino Diablo transfer reservoir site, located approximately 0.6 mile northeast of the intersection of Walnut Boulevard and Camino Diablo Road. Figure 2-13 illustrates the location of the transfer reservoir under this configuration.

The transfer reservoir and pumping plant would be designed as indicated above under "Description of Common Facilities". The plant would be designed with about 8,500 horsepower.

To provide electricity to the Camino Diablo transfer site, a transmission line would connect the new substation at the transfer reservoir site to an existing 230-kV PG&E transmission line approximately 1 mile west (Figure 2-13).

Old River No. 5 Pipeline. The Old River No. 5 pipeline would be identical to the Old River No. 2 pipeline from the intake facilities near SR 4 to an electric transmission line corridor located east of Bixler Road. From there, the Old River No. 5 pipeline would continue west to a point approximately 0.6 mile west of the transmission line corridor and just south of SR 4. From this point the Old River No. 5 pipeline would run south-southwest for approximately 0.5 mile. The pipeline would turn west for approximately 2.6 miles, crossing Byron Highway and the Southern Pacific Railroad tracks, then would turn southwest for approximately 0.6 mile to the Camino Diablo transfer reservoir site. Figure 2-13 illustrates the alignment of proposed Old River No. 5 pipeline.

Rock Slough/Old River No. 6 Configuration

Under this configuration, the Los Vaqueros pipeline and the transfer reservoir and pumping plant would be identical to those described above under "Rock Slough/Old River No. 5 Configuration". The intake facilities and pipeline alignment under this configuration are shown in Figure 2-14 and are described below.

Old River No. 6 Intake Facilities. Under this project configuration, the new supplemental Old River intake facilities would be located approximately 800 feet south of Indian Slough on Old River in the Delta (Figure 2-14).

Electricity would be supplied to the Old River No. 6 intake site by constructing a new transmission line connecting the new intake facilities with one of two existing WAPA transmission lines (69 kV or 230 kV) approximately 2.5 miles west of the intake site (Figure 2-14). The new transmission line would follow the alignment of the Old River No. 6 pipeline.

Old River No. 6 Pipeline. The Old River No. 6 pipeline would run west-southwest from the new Old River intake facilities, crossing SR 4 southeast of Discovery Bay. From a point approximately 1,000 feet south of SR 4 to its termination at the Camino Diablo transfer reservoir site, Old River No. 6 pipeline would be identical to Old River No. 5 pipeline. Figure 2-14 illustrates the alignment of Old River No. 6 pipeline.

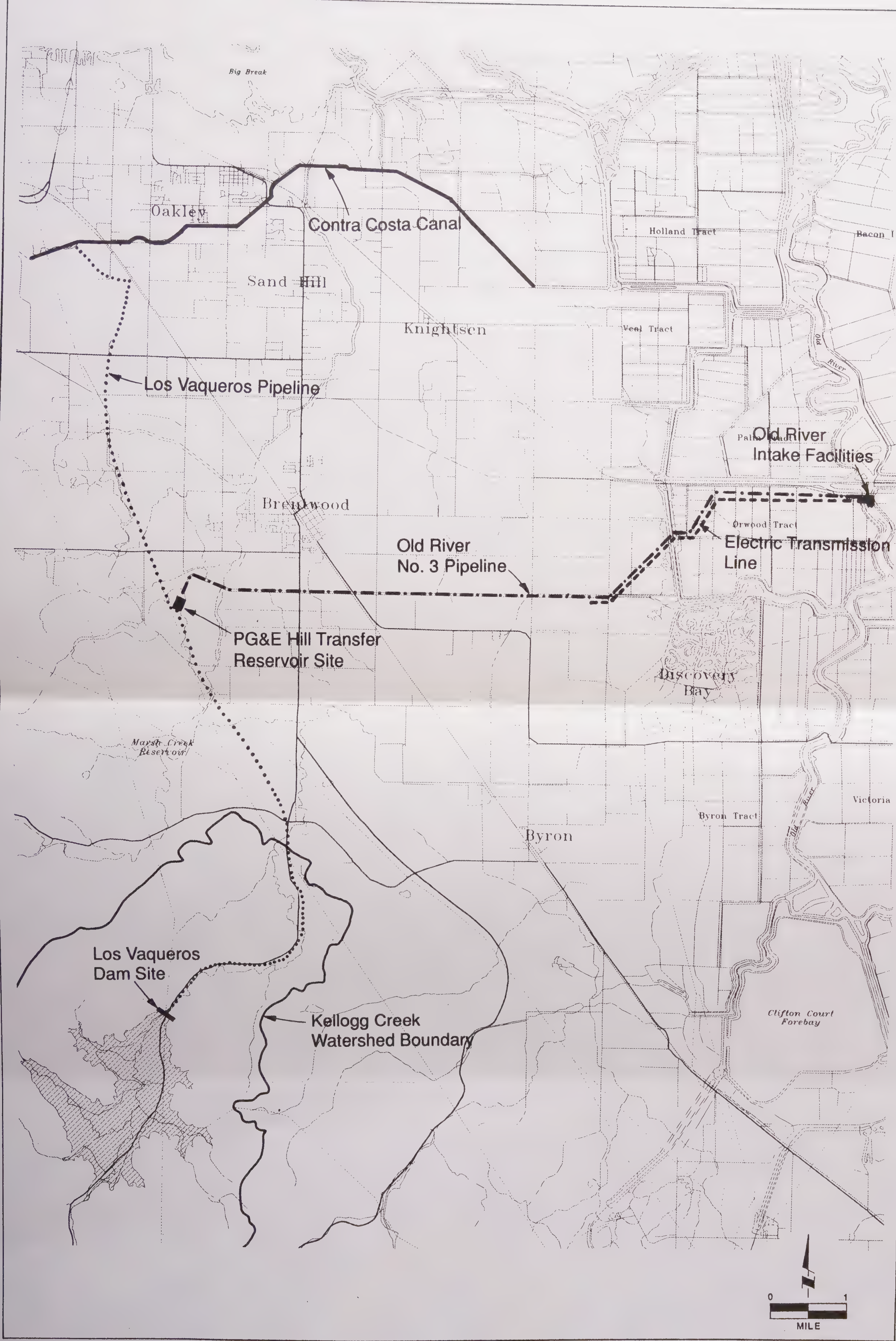


Figure 2-11. Los Vaqueros Reservoir Alternative - Rock Slough/Old River No. 3 Configuration

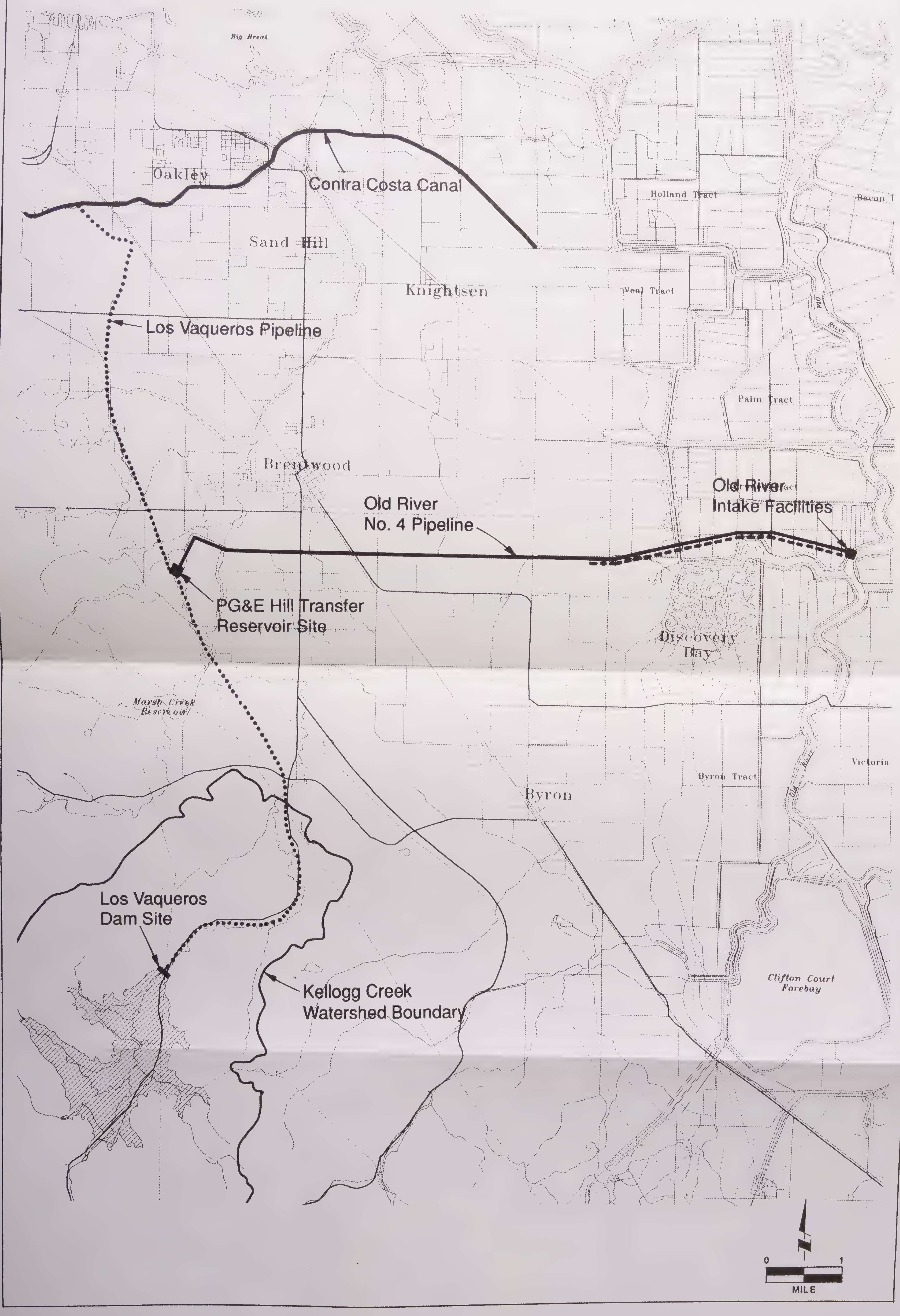


Figure 2-12. Los Vaqueros Reservoir Alternative - Rock Slough/Old River No. 4 Configuration

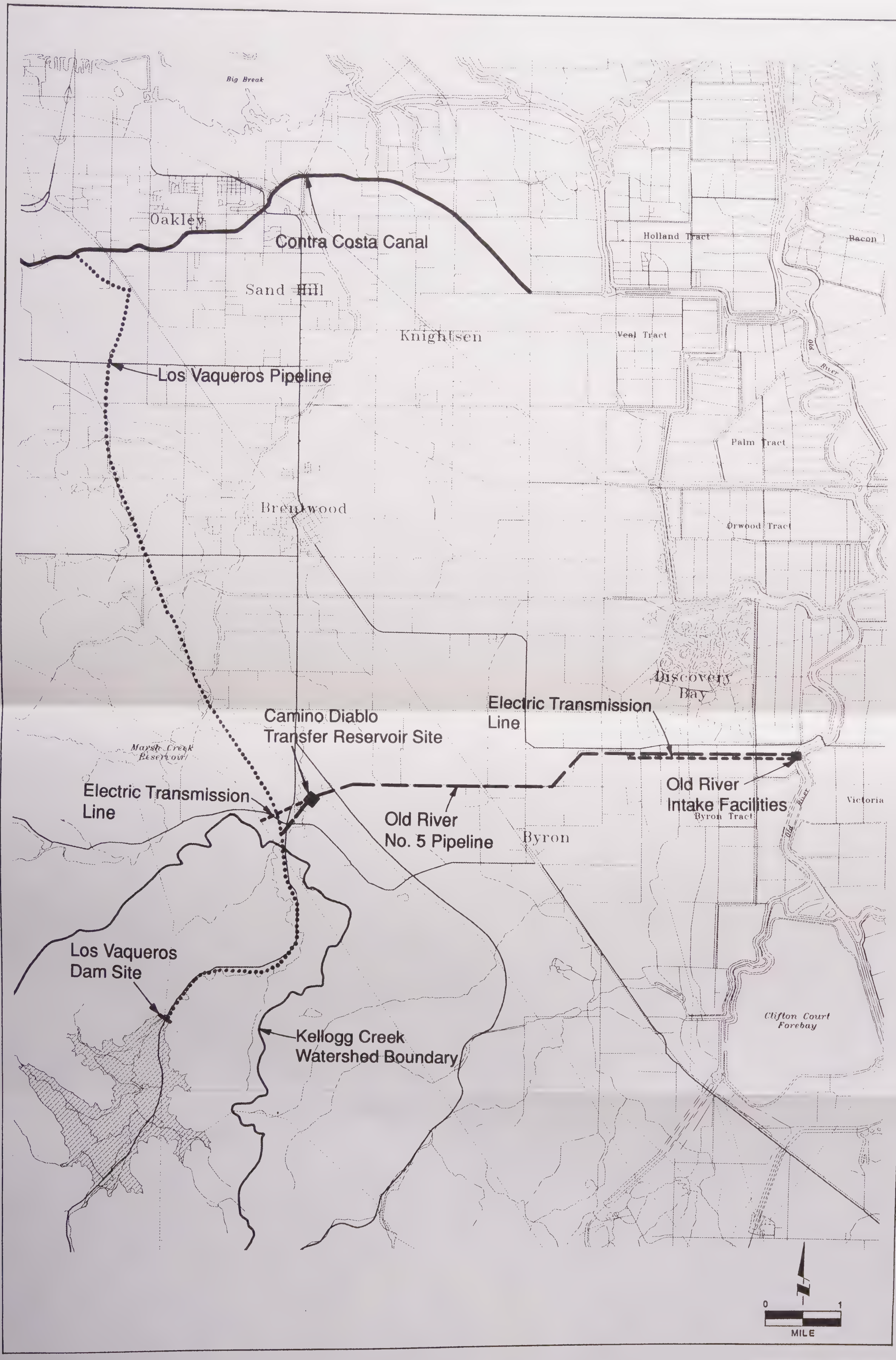


Figure 2-13. Los Vaqueros Reservoir Alternative - Rock Slough/Old River No. 5 Configuration

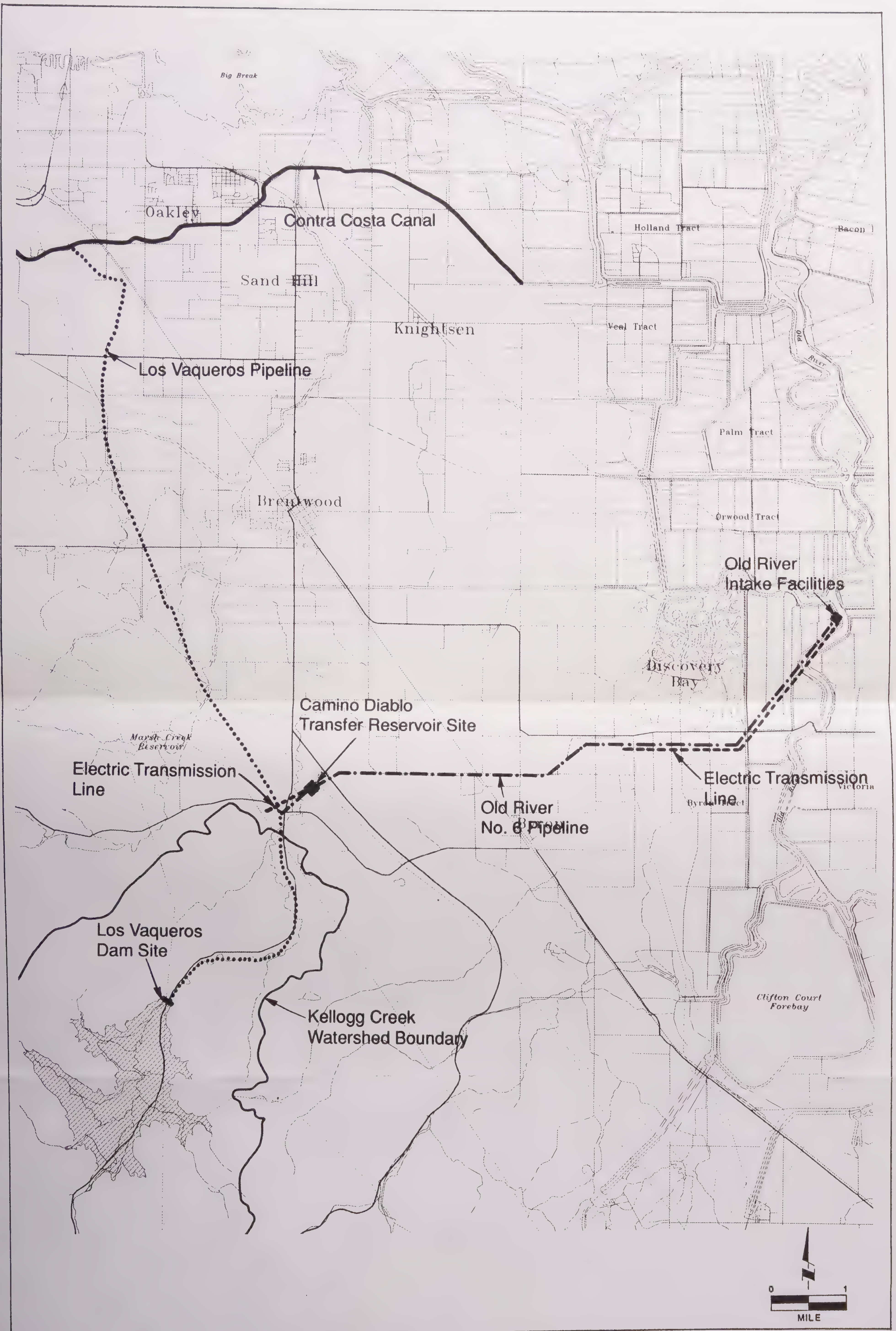


Figure 2-14. Los Vaqueros Reservoir Alternative - Rock Slough/Old River No. 6 Configuration

Rock Slough/Clifton Court Forebay Configuration

Similar to those configurations that use new supplemental Old River intake facilities, the Rock Slough/Clifton Court Forebay configuration would involve the construction and operation of new supplemental intake facilities in conjunction with the existing Rock Slough intake facilities (Figure 2-15). The Los Vaqueros Reservoir and overall operation of this configuration would be identical, as described above for other Los Vaqueros Reservoir Alternative configurations. The Los Vaqueros pipeline and the transfer facilities would be identical to those described above under "Rock Slough/Old River No. 1 Configuration". The intake location and the Clifton Court Forebay pipeline alignment are described below. DWR has preliminarily indicated that CCWD use of DWR's Clifton Court Forebay facilities could require substantial additional modifications. These modifications may include dredging Clifton Court Forebay to increase its capacity and expanding the tide gates at the entrance to Clifton Court Forebay.

Clifton Court Forebay Intake Facilities. The intake facilities for the Rock Slough/ Clifton Court Forebay configuration would be located adjacent to Clifton Court Forebay, southeast of Byron. The new intake facilities would include a new 250-cfs intake structure and an associated open sump-type pumping plant, new fish facilities, and a 1,400-foot-long earth-lined canal that would connect these new facilities to the California Aqueduct intake channel upstream of the Skinner Fish Facilities. The pumping plant would include six 42-cfs pumping units, and the design and operation of the Clifton Court Forebay fish facilities would be similar to those described above under "Description of Common Facilities". The intake pumping plant would be designed to produce 8,500 horsepower.

Electricity would be supplied to the Clifton Court Forebay intake site by constructing a transmission line from a new substation that would be located at the intake site to one of two existing WAPA transmission facilities (69 kV or 230 kV) that cross the site (Figure 2-15).

Clifton Court Forebay Pipeline. The Rock Slough/Clifton Court Forebay configuration would require a new 5.8-mile-long, 90-inch-diameter pipeline to deliver 250 cfs from the Clifton Court Forebay intake to the transfer reservoir located at the Kellogg site. The alignment of the Clifton Court Forebay pipeline is illustrated in Figure 2-15.

The pipeline would run from the new intake facilities approximately 0.6 mile northwest where it would cross to the west side of the Southern Pacific Railroad and the Byron Highway. The pipeline would parallel the railroad tracks for approximately 0.6 mile, turn west near the intersection of Clifton Court Road and Byron Highway, and run approximately 1.9 miles. The pipeline would then turn northwest and run approximately 0.6 mile. From here, the pipeline would run primarily northwest for approximately 2.1 miles to the transfer reservoir at the Kellogg site.

Construction of Los Vaqueros Reservoir Alternative

The Stage 2 EIR/EIS Technical Report (bound separately) provides information regarding construction methods, as well as details on the amount and transport of material required to construct the Los Vaqueros Reservoir Alternative. Figure 2-16 summarizes the type of materials required for the various phases of construction, lists potential source locations for each of the materials involved, and provides information regarding the estimated construction schedule.

The Stage 2 EIR/EIS Technical Report describes the following construction activities:

- foundation preparation,
- grouting of the embankment foundation area,
- dewatering of the embankment foundation area,

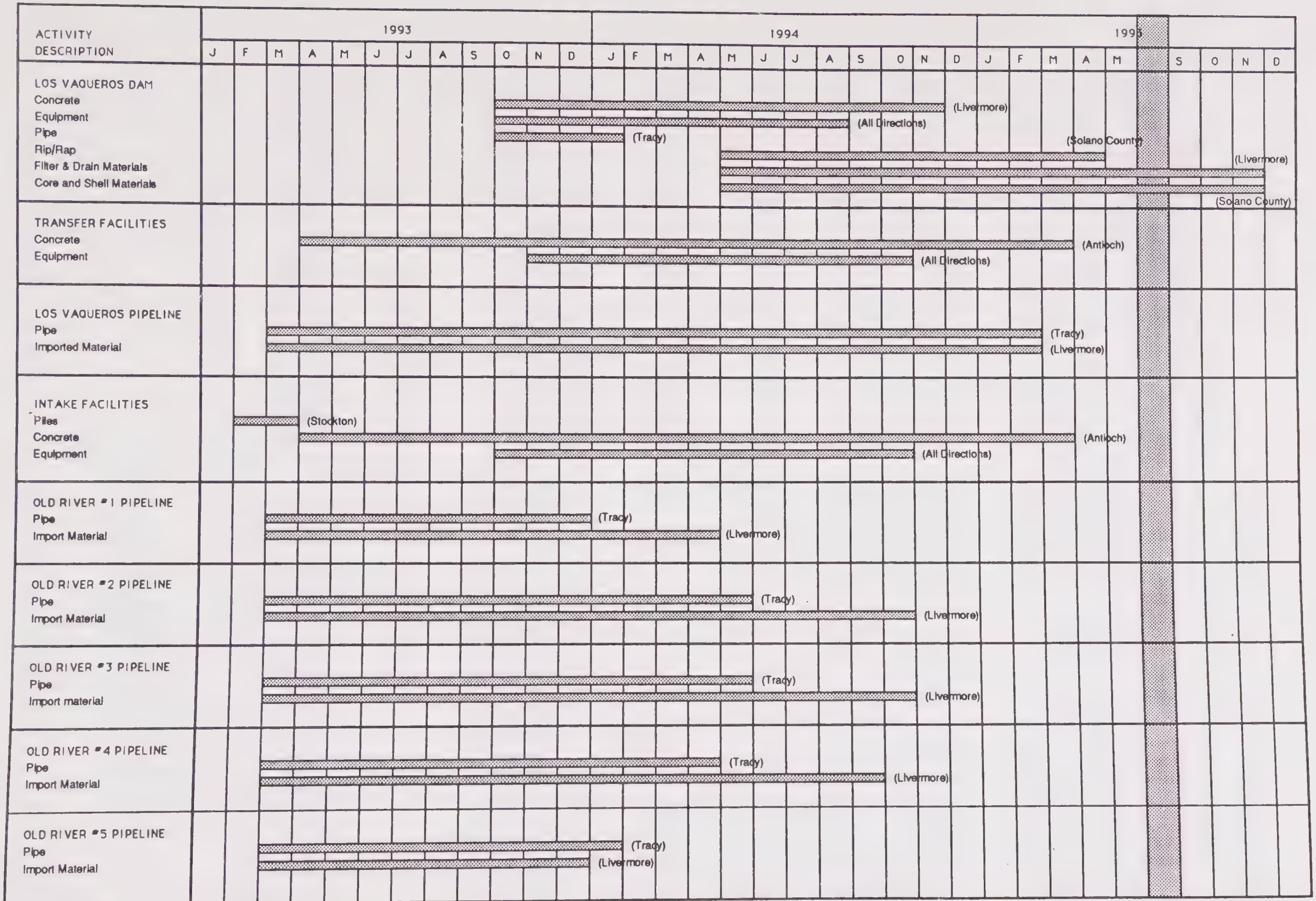


Figure 2-16. Los Vaqueros Reservoir Alternative - Construction Timing, Materials, and Sources

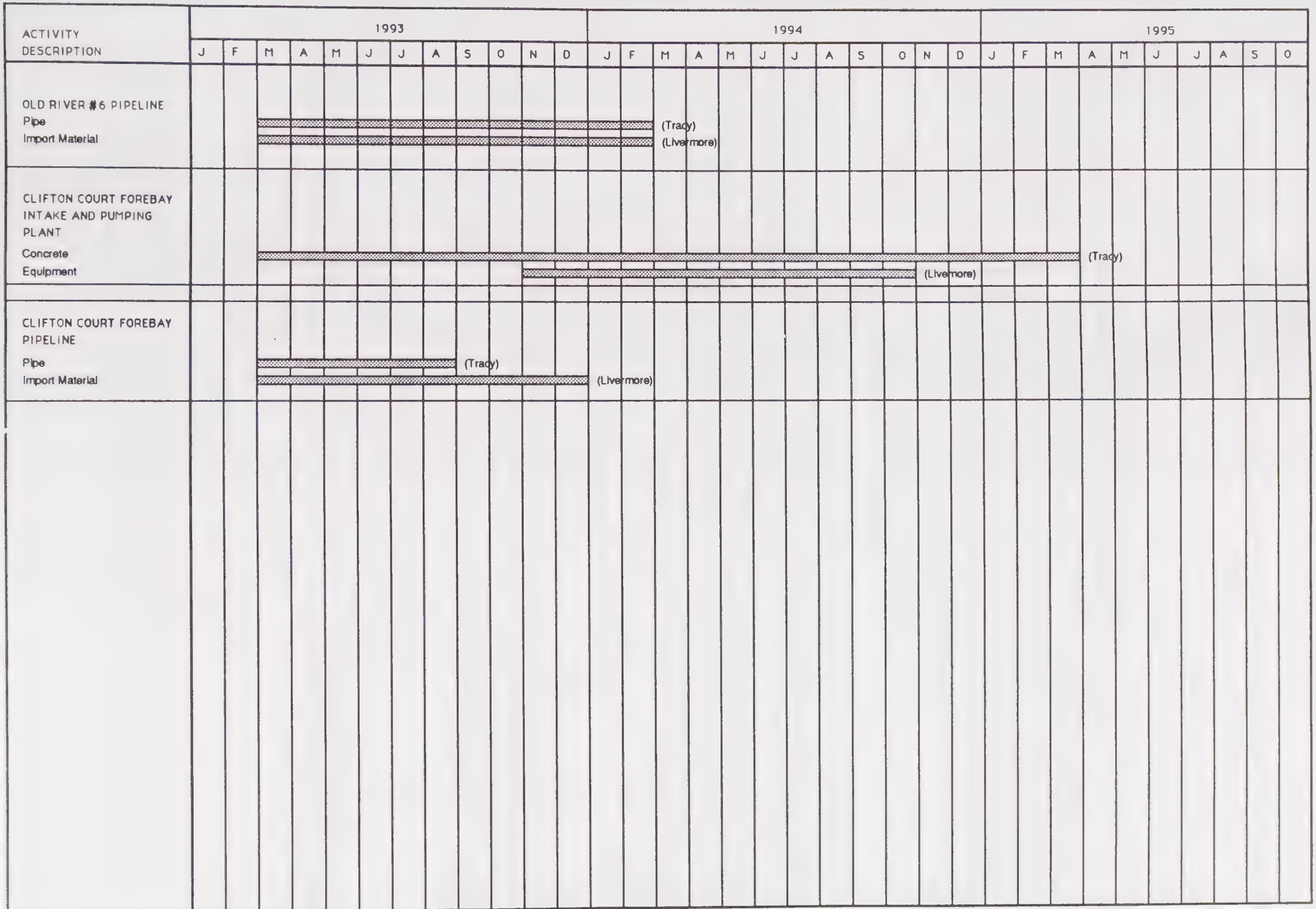


Figure 2-16. Continued

- Kellogg Creek diversion,
- placement of embankment materials,
- inlet/outlet works construction,
- spillway construction,
- reservoir clearing, and
- spoil material disposal.

Generally, dam construction activities would require between 25 and 170 workers at the site daily over the 23-month construction period. This estimate includes CCWD staff, engineers, contractor field office staffs, and construction workers. Construction of the intake facilities would require from one to 50 workers over the 24-month construction period. Construction of the transfer reservoir and pumping plant would require from one to 50 workers over the 24-month construction period. Los Vaqueros Reservoir and intake pipeline construction would require up to 35 workers per day onsite. Depending on the alternative, construction could take up to 20 months and would progress at a rate of approximately 100-200 feet per day. Construction of the electric transmission line would take place at a rate of approximately 1 mile per month, assuming that a 10-person crew is used.

KELLOGG RESERVOIR ALTERNATIVE

Like the Los Vaqueros Reservoir Alternative, this alternative is based on achieving project objectives through the construction of offstream reservoir storage facilities. The alternative involves construction of a 100,000-af storage reservoir at the Kellogg Reservoir site, located within the Kellogg Creek watershed immediately downstream of the Los Vaqueros Reservoir site (Figure 2-17); new intake and fish screening facilities; and all appurtenant structures required to convey Delta water from the new intake facilities to the reservoir and subsequently to the Contra Costa Canal. Except for the main reservoir site, the Kellogg Reservoir Alternative includes facilities essentially identical to the Los Vaqueros Reservoir Alternative using the conveyance facilities described above under the Rock Slough/Old River No. 5 configuration.

Project Operations

Under this alternative, the reservoir, intake, and conveyance system operations would be identical to those described above under the "Los Vaqueros Reservoir Alternative". Figure 2-17 shows the patterns of Delta diversions that would occur under this alternative at buildout of the CCWD planning area. Diversions would be identical to those shown for the Rock Slough/Old River configurations.

Costs of the Kellogg Reservoir Alternative

Detailed cost information for the Kellogg Reservoir Alternative is included in the Stage 2 EIR/EIS Technical Report (bound separately) and summarized below in the "Summary Comparison of Alternatives" section.

Description of Kellogg Reservoir Alternative Facilities

Because project operations and many project facilities would be identical to those described above under "Los Vaqueros Reservoir Alternative", the following descriptions include only those facilities that are unique to the Kellogg Reservoir Alternative and those facilities that are modifications of those presented

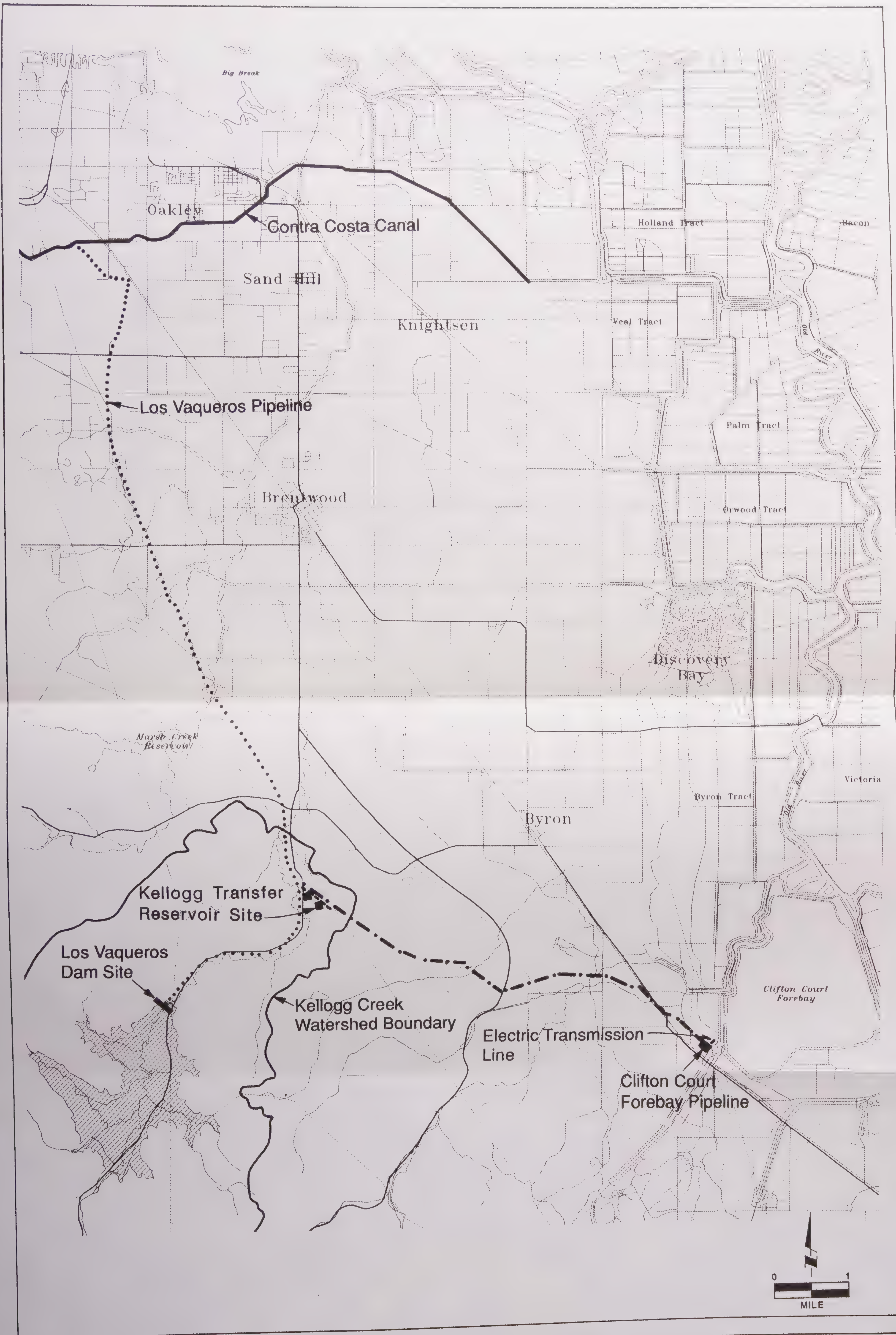


Figure 2-15. Los Vaqueros Reservoir Alternative - Rock Slough/Clifton Court Forebay Configuration

above under "Los Vaqueros Reservoir Alternative". The following sections describe the Kellogg Reservoir and the transfer pipeline.

Kellogg Reservoir

The Kellogg Reservoir would be the primary facility, providing CCWD with offstream storage for water quality enhancement and reliability storage. The reservoir would accommodate 100,000 af of water, with a maximum allocation of 56,000 af of water for emergency storage, 30,000 af of water for water quality enhancement, 10,000 af of dead storage, and 4,000 af of evaporation storage. When full, the reservoir pool would inundate a maximum of approximately 1,600 acres. Figure 2-17 shows the Kellogg Reservoir area.

The Kellogg Reservoir Alternative would involve the construction of Kellogg dam and nine saddle dams, a spillway, and inlet/outlet facilities. The Kellogg dam and saddle dams would include all seismic safety design features described above under the "Los Vaqueros Reservoir Alternative".

Kellogg Dam and Associated Saddle Dams. The Kellogg dam site is located on Kellogg Creek approximately 1,600 feet south of the intersection of Camino Diablo and Vasco Roads. The estimated dam height would be 158 feet, with the dam crest at approximately the 305-foot elevation. Similar to the Los Vaqueros dam, the Kellogg dam and nine associated saddle dams would be zoned earthfill structures using materials that would be both imported and excavated from within the reservoir inundation zone. The location of the Kellogg dam and nine saddle dams are illustrated in Figure 2-17.

Spillway. The spillway for the Kellogg Reservoir would be located in a ridge about 1,500 feet east of the main dam site, and would consist of a concrete-lined chute (Figure 2-18). The spillway would be designed to safely pass the probable maximum flood without overtopping the dam. Spillway flows would be released to Kellogg Creek downstream of Kellogg dam.

Inlet/Outlet Works. The conceptual design of the inlet/outlet works for the Kellogg dam site consists of a series of three concrete and steel-lined pressure tunnels that would enable the reservoir to be drained from different depths within the reservoir. The pressure tunnels would be connected by a vertical control shaft that would regulate water flow through the pressure tunnels. These facilities would be used for both filling and draining of the reservoir. The layout and profile of these facilities are shown in Figure 2-18.

Recreation Planning

A detailed conceptual recreation plan has not been developed for the Kellogg Reservoir Alternative. CCWD anticipates, however, that a recreation plan for this alternative would provide essentially the same kind of recreation experiences and intensity of use as the conceptual recreation plan developed for the Los Vaqueros Reservoir Alternative. In addition, CCWD would apply the same resource protection guidelines to the recreation facilities under this alternative as are described for the Los Vaqueros Reservoir Alternative.

Vasco Road and Utility Relocations

As with the Los Vaqueros Reservoir Alternative, the Kellogg Reservoir Alternative would require the relocation of Vasco Road and several utility facilities. Although the relocation of Vasco Road would be identical to that described for the Los Vaqueros Reservoir Alternative, the specific utility relocation would be somewhat different.

Under this alternative, two PG&E electric transmission lines, located at the northeastern edge of the Kellogg Creek watershed, would require relocation in addition to the one 230-kV electric transmission line

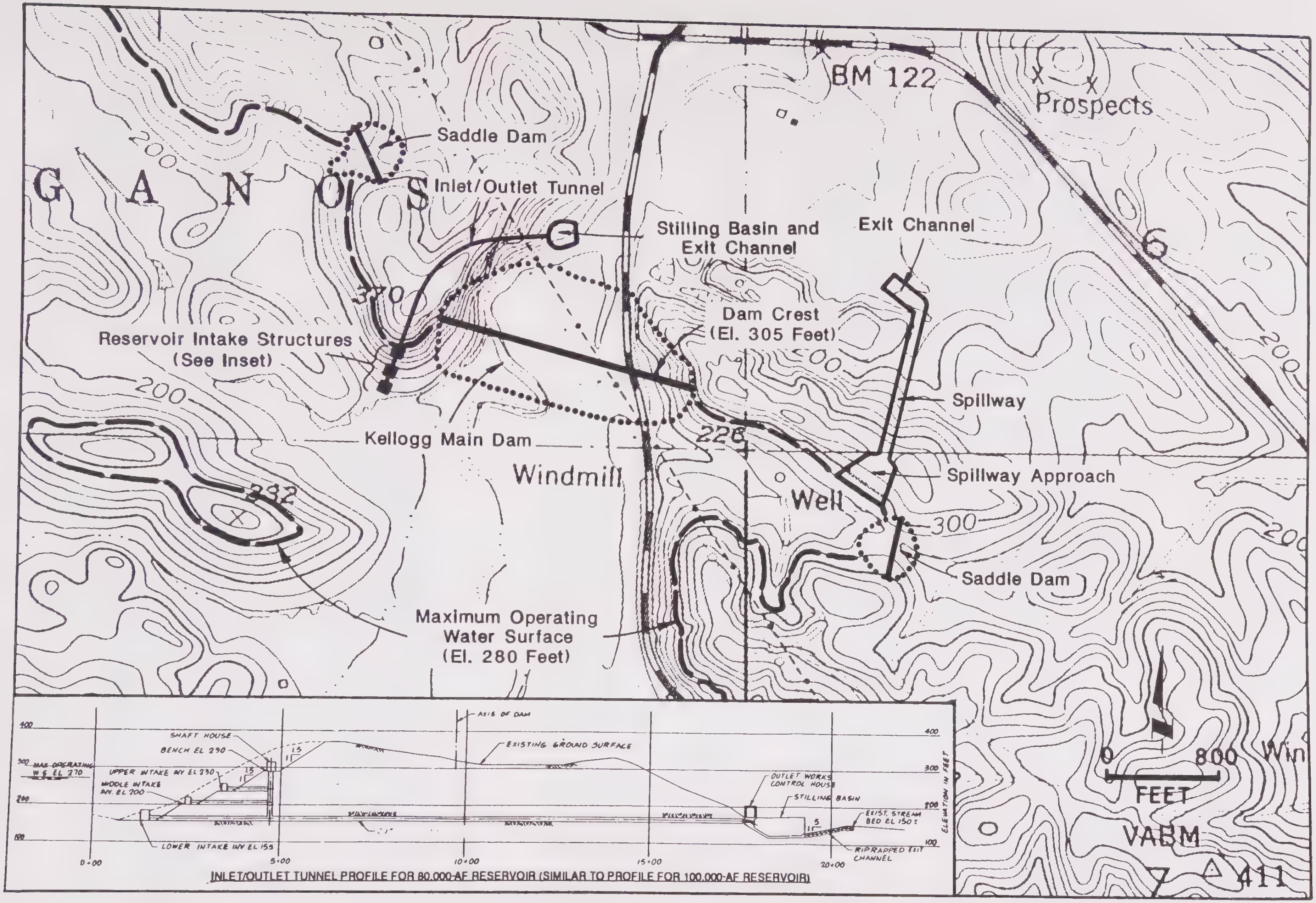
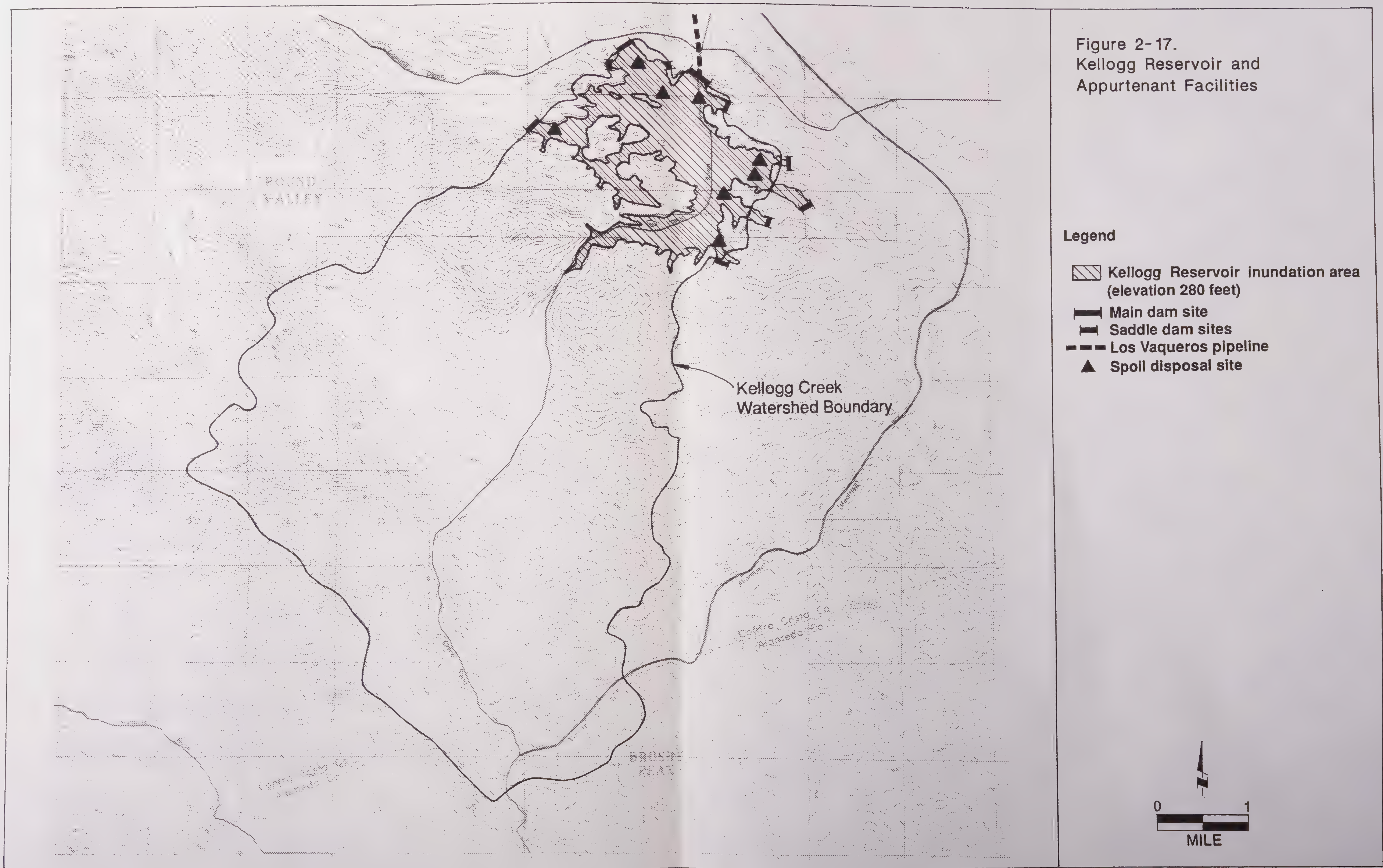


Figure 2-18. Kellogg Dam and Appurtenant Facilities

Figure 2-17.
Kellogg Reservoir and
Appurtenant Facilities



and three natural gas pipelines described for the Los Vaqueros Reservoir Alternative. The petroleum pipelines would be left in place, but detention basins would be constructed to prevent any spills that could result from a rupture in the petroleum pipelines from entering Kellogg Reservoir.

The relocation corridors for each facility under this alternative are shown in Figure 2-19. The potential effects of these relocations on the environment are fully described in the Vasco Road and Utility Relocation Project EIR, and mitigation measures were adopted by CCWD that reduced almost all impacts to less-than-significant levels (Jones & Stokes Associates 1990).

Construction of Kellogg Reservoir Alternative

Construction of the Old River intake facilities, Old River pipeline, Los Vaqueros pipeline, and Camino Diablo transfer reservoir and pumping plant facilities is described above under "Construction of Los Vaqueros Reservoir Alternative". Figure 2-20 summarizes the type of materials required for construction of the Kellogg Reservoir Alternative, lists the source locations for each of the materials, and provides information regarding an estimated construction schedule. Detailed information regarding construction methods and the amount and transportation of construction materials is included in the Stage 2 EIR/EIS Technical Report (bound separately).

The work force required to construct this alternative would be similar to that described for the Los Vaqueros Reservoir Alternative. The construction period, however, would be longer.

DESALINATION/EBMUD EMERGENCY SUPPLY ALTERNATIVE

This alternative is a nonreservoir alternative that includes the construction of a 100-million gallons per day (mgd) desalination plant to treat water diverted through the Contra Costa Canal to achieve the project water quality objective of 65 mg/l chloride and 50 mg/l sodium, and the construction of a 48-inch pipeline to connect EBMUD's Mokelumne Aqueduct to the Contra Costa Canal to meet a portion of CCWD's emergency water supply requirements should a Delta emergency preclude the use of Delta water.

Although the above facilities constitute the primary features of this alternative, various other new facilities would be required. These facilities include:

- a blending facility,
- a pumping plant and pipeline parallel to the Contra Costa Canal to expand flows from 350 cfs to 500 cfs between pumping plant no. 1 and pumping plant no. 4,
- an EBMUD intertie pipeline and connection to the Mokelumne Aqueduct,
- a 125-mgd filtration plant to provide pretreatment for the desalination process, and
- a waste disposal pipeline to convey a maximum of 25 mgd of brine reject from the desalination plant to Suisun Bay at Stake Point.

In addition to these facilities, the Rock Slough intake channel would be widened to provide maximum flow of 500 cfs.

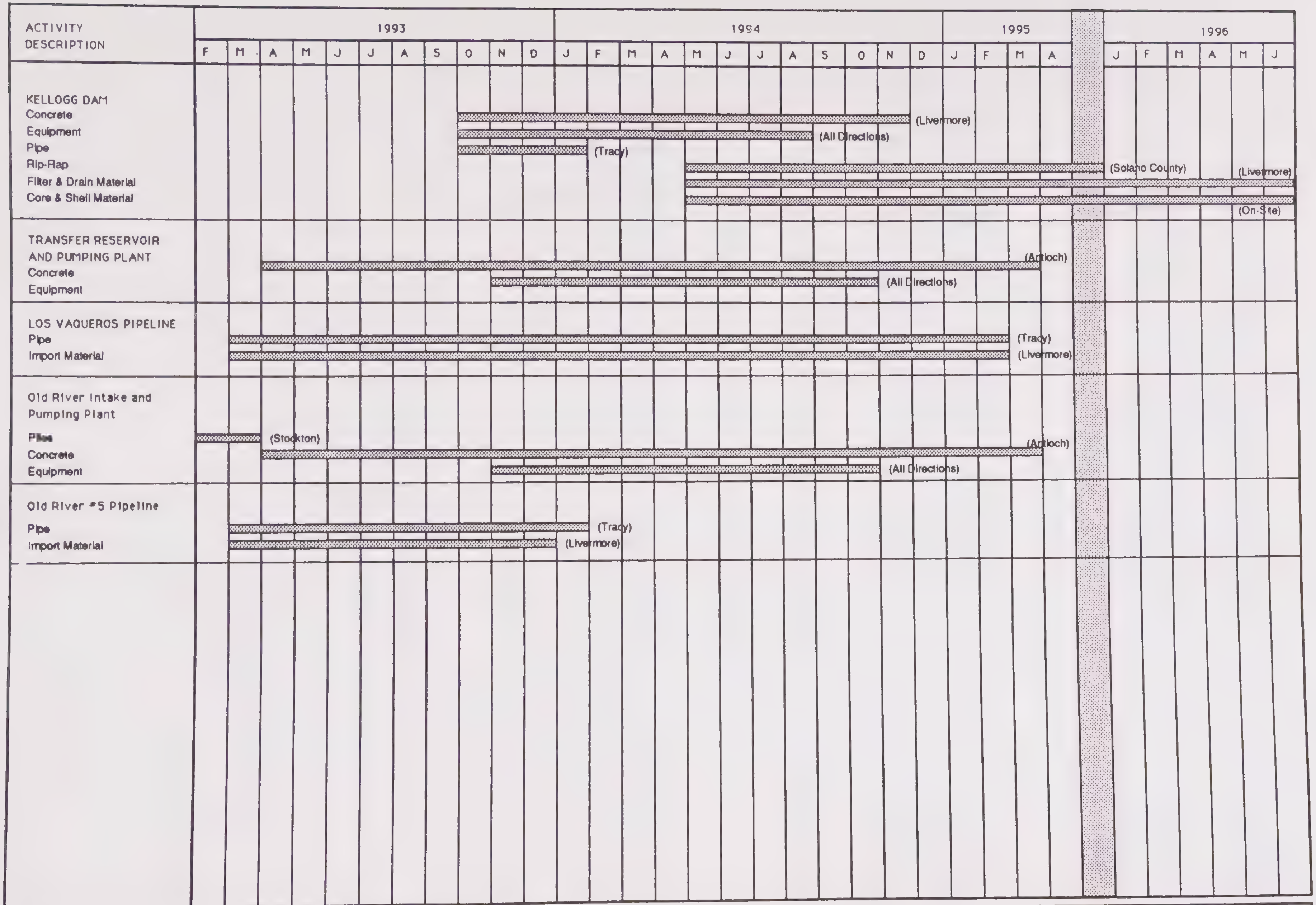


Figure 2−20. Kellogg Reservoir Alternative - Construction Timing, Materials, and Sources

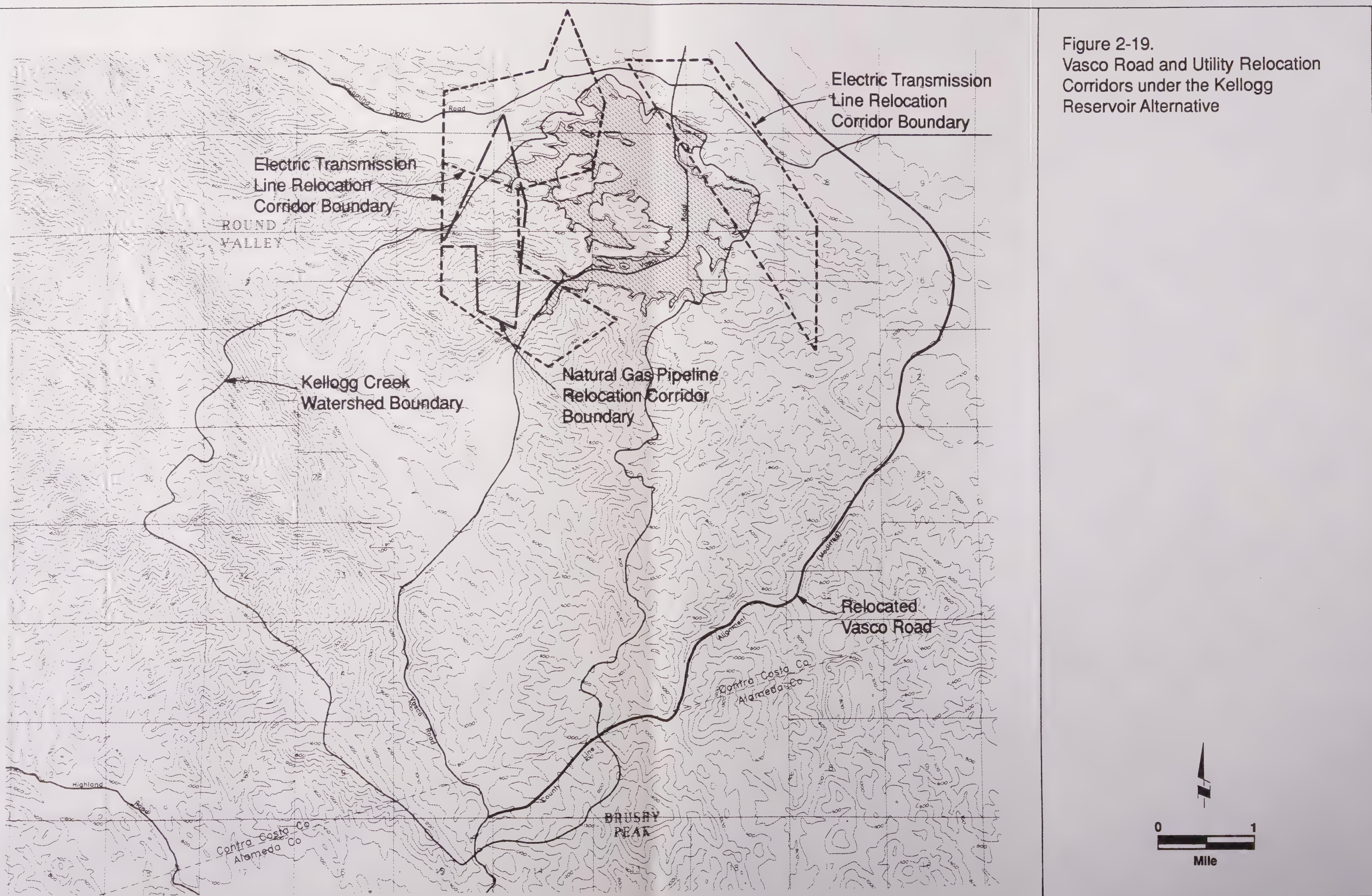


Figure 2-19.
Vasco Road and Utility Relocation Corridors under the Kellogg Reservoir Alternative

The desalination plant would be located at a 99-acre site east of Oakley (Figure 2-21). The site is bounded by the Contra Costa Canal on the north and Cypress Road on the south. This site was selected based on the following criteria:

- proximity to the Contra Costa Canal,
- location upstream of major customers,
- compatibility with local land use plans,
- level topography to minimize earthwork, and
- absence of wetlands.

Figure 2-22 provides a general layout of the desalination facilities.

Desalination Plant Performance Objectives

Projections of the reverse osmosis system's performance, based on limited data for key water quality parameters, indicate that approximately 80% of the plant feedwater would be recovered as usable water supplies, while 20% of the feedwater would be rejected as brine waste. Actual recovery could be somewhat higher or lower, but an 80% recovery rate was used for planning purposes.

Table 2-3 shows the projected levels of water quality constituents in the raw feedwater; the permeate, or "pure" water supplies; and the brine concentrate. The estimated levels of water quality constituents in the water produced by the plant are shown in Table 2-3 and represent operations during water quality blending procedures with chloride levels in the feedwater of 250 mg/l chloride.

Delta Diversions

Because an estimated 20% of the desalination plant feedwater would be rejected as brine waste, the total amount of water diverted from the Delta by CCWD would be greater for this alternative than under other alternatives. Under the Desalination/EBMUD Emergency Supply Alternative, diversions would continue to be made at the Rock Slough intake, but additional diversions would occur during dry periods when salinity in the Delta is high. This alternative assumes that Reclamation would provide CCWD with additional water supplies from CVP water that is not under contract. Figure 2-23 shows CCWD's average monthly Delta diversions under this alternative in average and critical years at buildout of the CCWD planning area. Figure 2-24 schematically displays the CCWD water system with the Desalination/EBMUD Emergency Supply Alternative.

Chemical Storage

Several different chemicals would be used in the operation of the desalination plant to prepare the feedwater for the various treatment process. All the chemicals are approved by the California Department of Heath Services (DHS) for use in potable water systems, and all chemicals would be applied according to DHS standards. The desalination plant would be designed such that, in the event of a chemical spill, a system of sumps and drains would contain and convey the chemicals to a spill containment basin where they could be pumped to the waste washwater basin or to an unloading station for transfer to a waste tanker truck and disposal at an appropriate site.

Brine Disposal

This alternative assumes that the brine waste would be disposed of in Suisun Bay. Other options explored for brine disposal include evaporation and deep-well injection. Because of technical and environmental considerations, however, both of these options were eliminated from consideration.

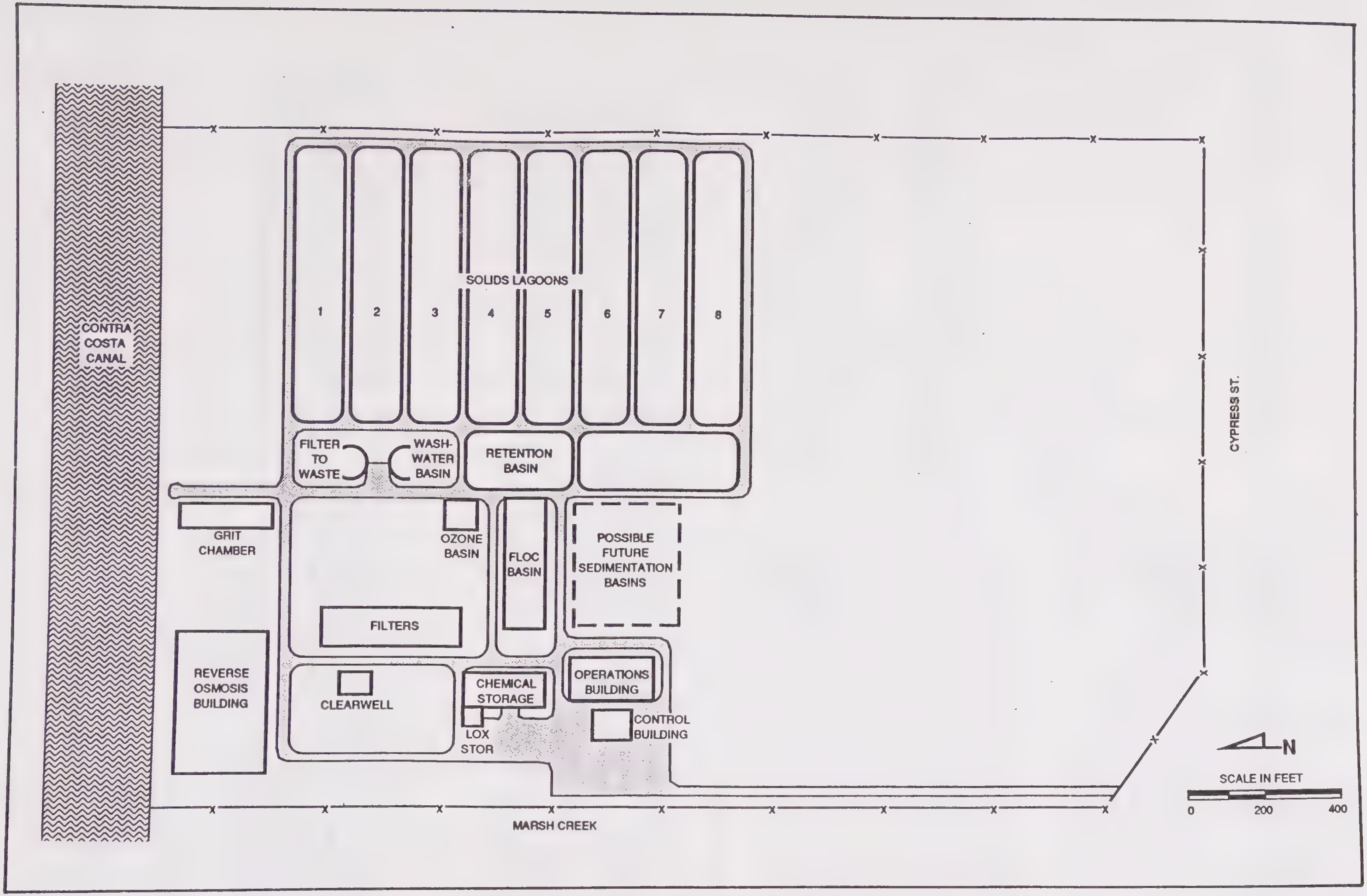


Figure 2-22. Desalination Plant Layout

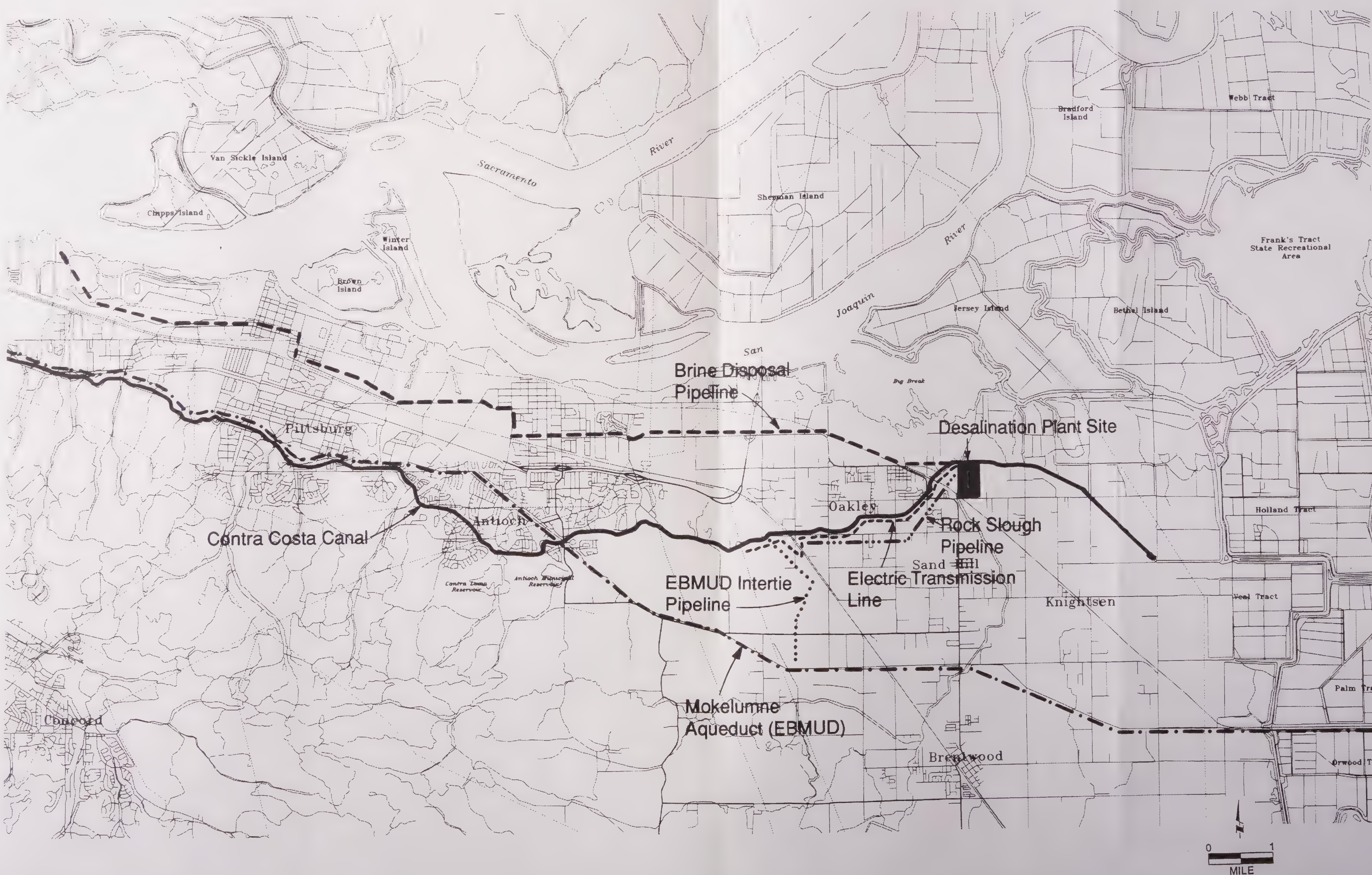


Figure 2-21. Desalination/EBMUD Emergency Supply Alternative

Table 2-3. Desalination/EBMUD Emergency Supply Alternative
Projected Water Quality (mg/l)

Parameter	Feedwater	Permeate	Brine
Chloride	250	15	1,215
Sodium	192	11	932
TDS	733	38	3,526
Potassium	0.1	0.5	29
Magnesium	27	0.9	134
Calcium	20	0.7	99
Bicarbonate	46	3	225
Nitrate	2	0.2	10
Sulfate	178	6	883
Silica	18	0.6	89

Source: Blackmer pers. comm.

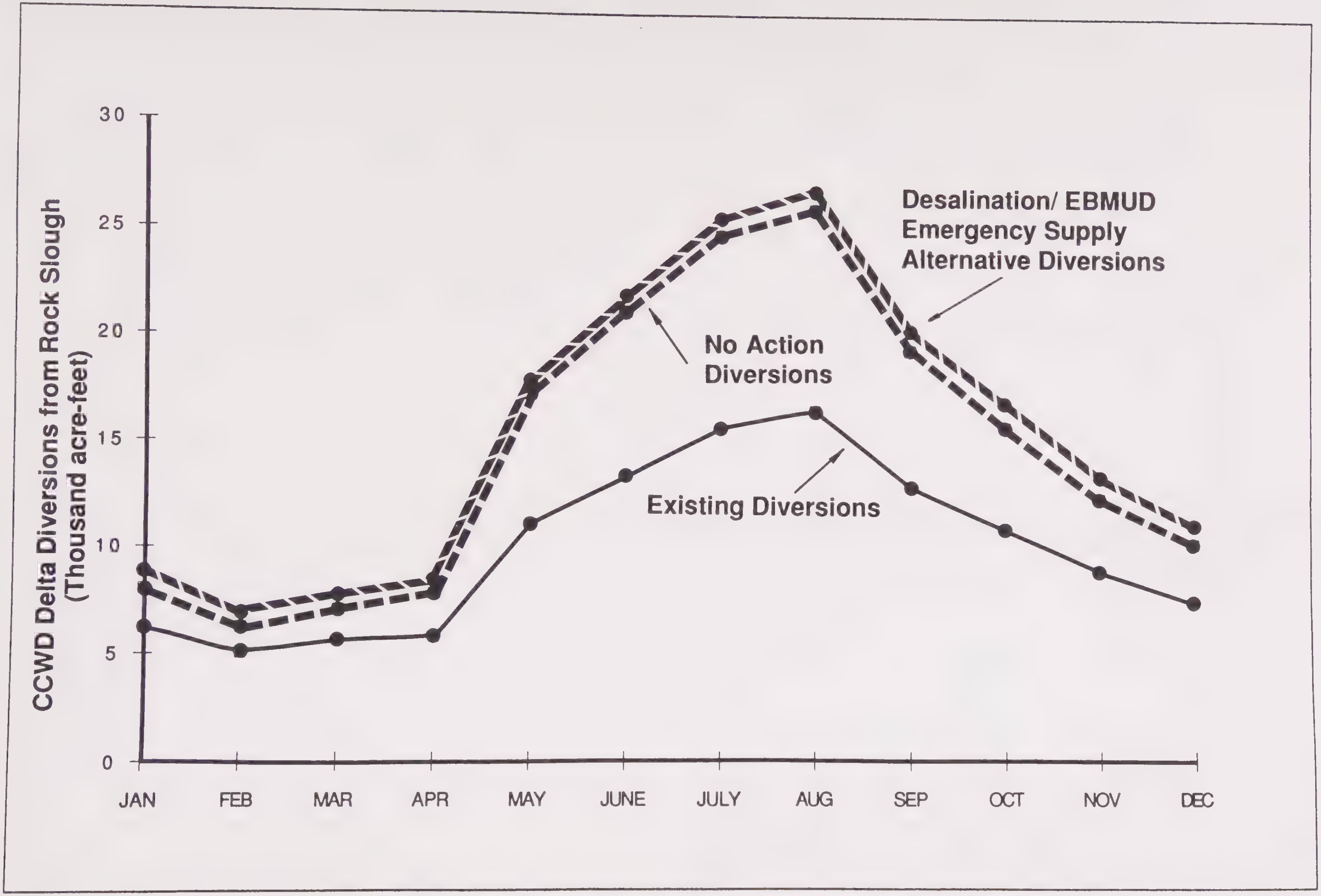


Figure 2-23. Desalination/EBMUD Emergency Supply Alternative Average Monthly Delta Diversions

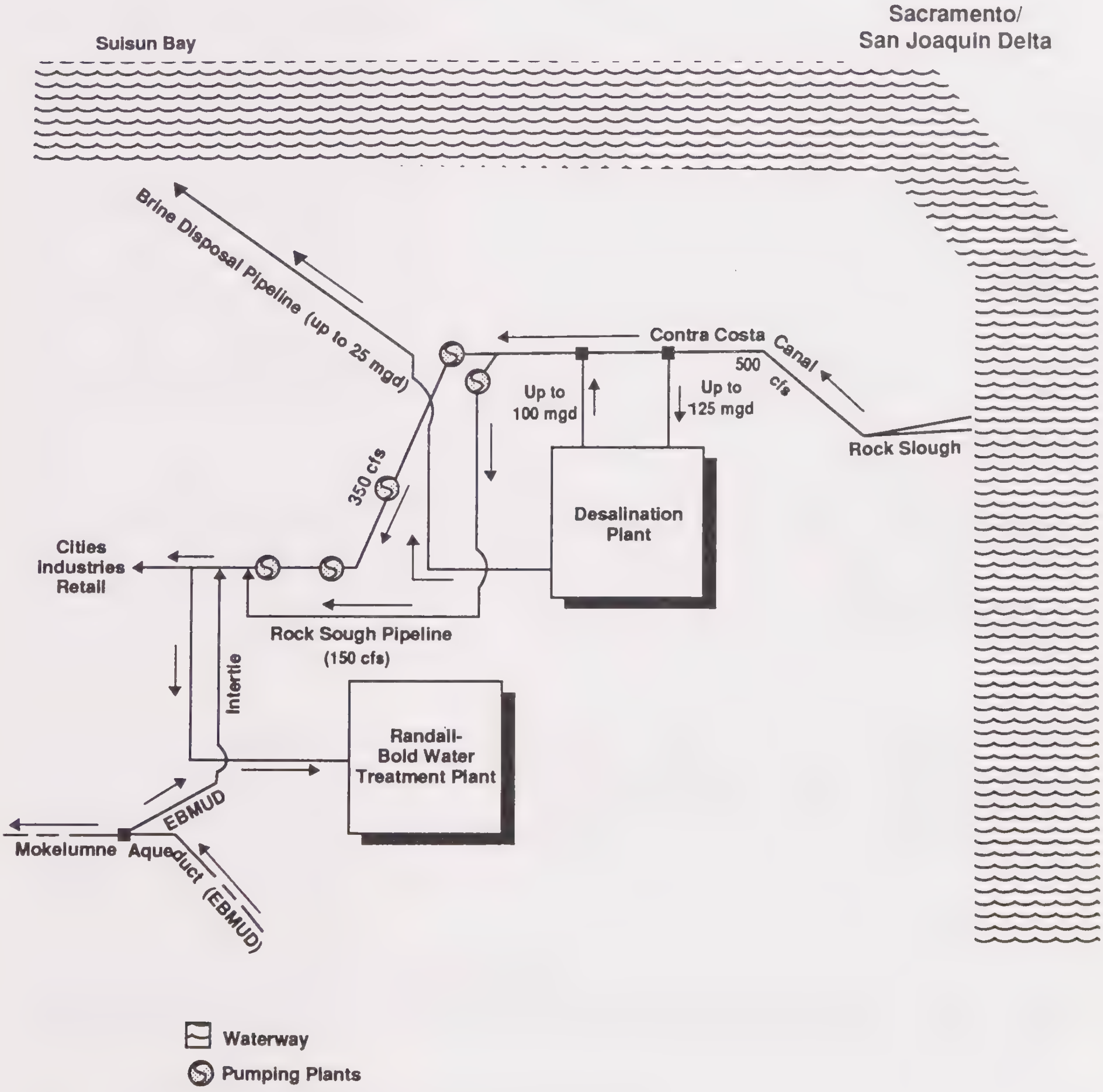


Figure 2–24. Flow Diagram of CCWD Water System with Desalination/EBMUD Emergency Supply Alternative

Brine discharge into Suisun Bay would require a discharge permit from the San Francisco Bay Regional Water Quality Control Board (SFRWQCB) contingent on conformance with the SFRWQCB's Basin Plan. Preliminary analysis of heavy metal concentrations in CCWD's raw water supplies indicate that the discharge requirements could probably be met without treatment of the brine, although cadmium levels are close to discharge limits. During desalination plant operation, brine discharge is estimated to range from 5 mgd under normal operation, when blending is not required, to 25 mgd at peak plant flow rates during periods of poor water quality.

EBMUD Intertie Pipeline

Under this alternative, an intertie with EBMUD's system would be used to supply a portion of CCWD's emergency supply needs as described in Chapter 1. It is assumed that EBMUD would be able to supply a maximum of 11,500 af of water for use during some emergency situations that reduce or eliminate CCWD's ability to provide water service from its diversion point in the Delta. At a minimum, this emergency supply would be provided at a rate of 50 mgd, which is approximately one-third of CCWD's average daily demand, excluding major industrial customer demand. This minimum rate is in accordance with statewide planning for minimum emergency service in the event of a total failure of normal supply. At this minimum rate of delivery, the 11,500 af available from EBMUD, coupled with the emergency supply stored at Contra Loma Reservoir, would provide CCWD's municipal customers with a 95-day emergency supply. This duration of emergency service would be the same as that provided by the reservoir alternatives, although consumption would be limited to domestic and indoor residential uses.

It is assumed that no emergency supply would be available from EBMUD during certain types of emergencies. For example, depending on location, a major levee failure in the Delta could render CCWD's water supply and EBMUD's main water supply, the Mokelumne Aqueduct, which crosses several Delta islands, unusable. Under these circumstances, it is possible that no emergency water supply would be available from EBMUD.

Power Requirements

Energy demands of the desalination plant would be high because of the energy requirement of the reverse osmosis process. The plant would require approximately 12.5 megawatts of electricity per year, which would be from a PG&E electric transmission line located approximately 3.5 miles west of the plant. The new transmission line would generally follow the alignment of the Contra Costa Canal as indicated in Figure 2-21.

Sanitary Sewage Disposal

Sanitary sewage from the operations and control building would drain to a septic tank and be disposed of into a leach field. The leach field would be located a minimum of 200 feet from the Contra Costa Canal in accordance with DHS requirements.

Costs of Desalination/EBMUD Emergency Supply Alternative

Detailed cost information for this alternative is included in the Stage 2 EIR/EIS Technical Report (bound separately) and is summarized below in the "Summary Comparison of Alternatives" section.

Description of Facilities

Improvement to the Rock Slough Intake Channel

The existing Rock Slough intake channel extends for 4 miles between the Rock Slough intake and pumping plant no. 1. The earth-lined channel has a trapezoidal cross section, and the bottom of the channel is approximately 24 feet wide and 7.5 feet below sea level. The channel is 69 feet across at sea level and has a capacity of 328 cfs.

Under this alternative, the channel would be widened by 23 feet to accommodate a maximum flow of 500 cfs, assuming that the channel depth and side slopes remain the same and that the maximum velocity is limited to 1.16 cfs.

Desalination Plant

The desalination plant would be capable of treating up to 125 mgd of feedwater from the Contra Costa Canal and producing 100 mgd of product water and 25 mgd of brine reject. The plant process would consist of a conventional (direct) filtration treatment followed by desalting. Figure 2-25 represents a schematic of the desalination plant process flow.

Pretreatment. To prevent fouling of the membrane surfaces and the formation of scale, pretreatment of the feedwater is required. Pretreatment would involve passing the feedwater through a 240- by 60-foot-long, concrete grit chamber and subsequently through a basin where it would be disinfected by injection with ozone. The ozone basin would be an approximately 60- by 60-foot concrete structure separated into compartments. Although some odorous off-gases would be produced during this process, ozone destruction units at the tops of the basin compartments would prevent the escape of gases. After ozone disinfection, several chemicals would be mixed into the flow to control or adjust pH and prevent scaling, and the water would be routed to a series of five 60- by 60-foot flocculation basins where coagulation would occur.

Process flows would then be routed to 15 concrete filtration units, with each having two bays. Each bay would be 16 feet wide by 32 feet long and would consist of a 10-foot-deep bed of sand and anthracite filter media. The process flows would be applied at the top of the filter media and flow by gravity throughout the filter media. When pressure losses through the filter reached a predetermined point, the filter would be backwashed to remove the deposited particulate matter. The waste washwater would be conveyed to a washwater basin where a portion of the water would be recycled through the plant. The remaining sludge would be pumped into a lagoon.

After the filtration process, the feedwater would be pumped into a clearwell. The clearwell would provide storage and a sump for desalination feedwater pumps, backwash pumps, and process and utility water pumps. The clearwell would be a 40-foot-square by 22-foot-high concrete structure with a capacity of 250,000 gallons.

Desalination Facilities. From the clearwell, the water would be pumped into a 350- by 250-foot desalination building, which would house the reverse osmosis membranes, piping, booster pumps, cartridge filters and chemicals, as well as space for offices, membrane storage, chemical storage, spare parts, and instrumentation.

Before desalination, pH would be adjusted chemically to prevent scale formation from occurring on the reverse osmosis membranes. Booster pumps would then be used to force the feedwater through the reverse osmosis units at 180 pounds per square inch (psi). This process separates the permeate, or "pure" water, from the brine.

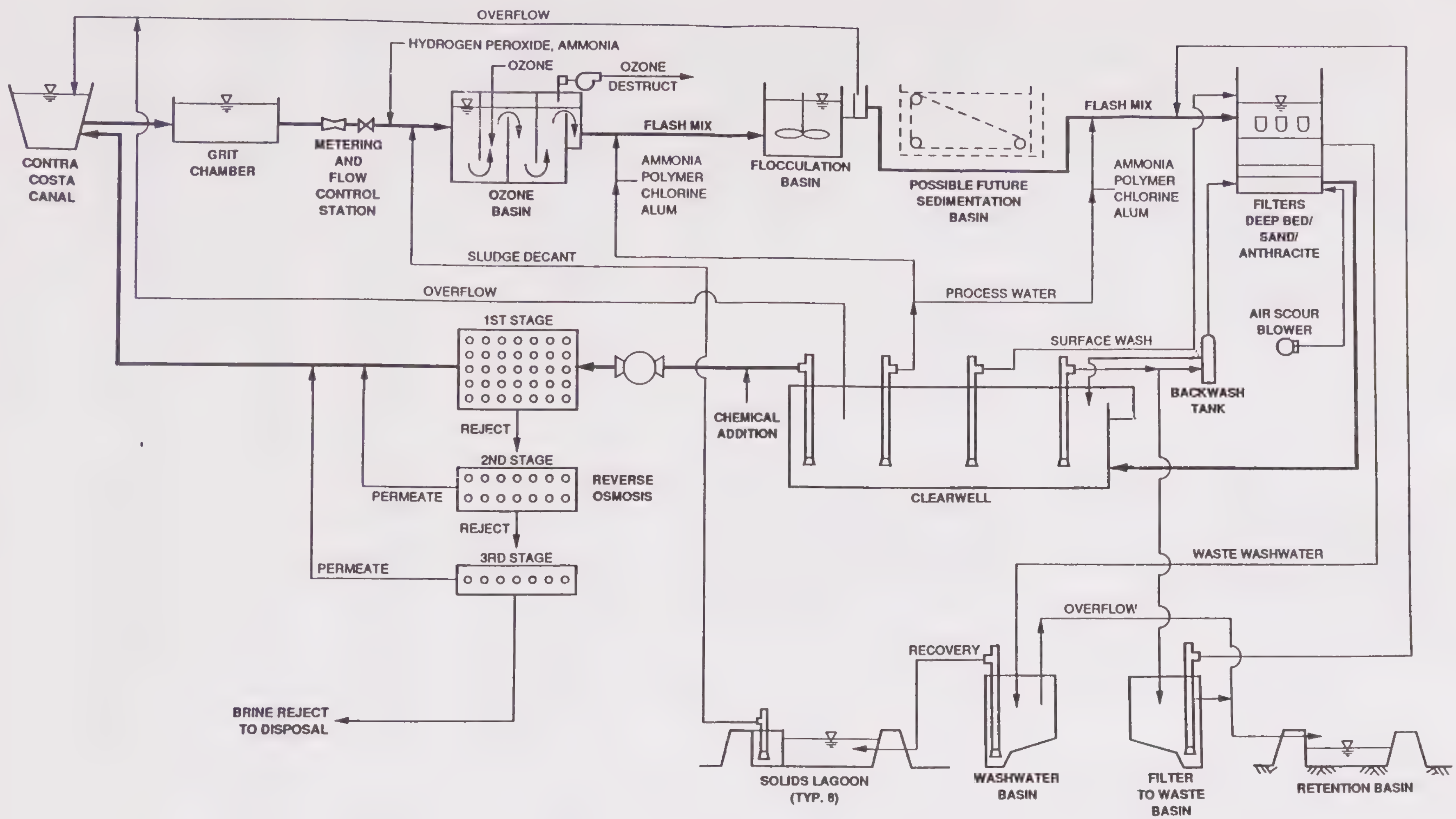


Figure 2–25. Desalination Plant Process Flow Schematic

The reverse osmosis units, rated at 2 mgd each, would include 50 parallel control blocks consisting of a series of filters and reverse osmosis membranes. At each stage in each control block, feedwater would be forced through a membrane, with "pure" water being routed back to the Contra Costa Canal and the brine reject constituting the feedwater for the next stage in the control block. The process would be repeated until the desired recovery rate is achieved. The brine reject from the final stage would then be conveyed through a pipeline for disposal in Suisun Bay. For details regarding brine disposal, see below under "Brine Disposal Pipeline".

The number of control blocks operating at any time can be adjusted according to the demand for desalinated water supplies needed for blending in the Contra Costa Canal to achieve CCWD's water quality objectives.

Solids Lagoons. Eight earthen solids lagoons would be constructed adjacent to the direct treatment facilities, and would be used to store and concentrate settled water solids from the backwashing of filters and sludge from the sedimentation basins and washwater basins. The solids lagoons would be 750 feet long by 150 feet wide (2.4 acres). The lagoon depths would be 4 feet.

Once the solids from the backwash water into the lagoons separate out by gravity, the clear water at the top of the water column would be pumped back into the feedwater line to be recycled through the desalination plant. When the lagoons become full of solids, the sludge layer would be allowed to drain and air dry. The sludge would then be removed for disposal at local dump sites. The removal and disposal operations are expected to be done annually. Approximately 40,000 cubic yards (cu yds) of sludge would be produced each year.

Brine Disposal Pipeline. The brine disposal pipeline would be 36 inches in diameter and convey the brine reject from the desalination plant to outfall facilities off Stake Point, west of the City of Pittsburg. The discharge facilities would consist of an outfall diffuser designed to meet SFRWQCB standards for dilution. Figure 2-21 illustrates the approximate alignment of the brine disposal pipeline and the location of the outfall facilities. No additional pumping plants would be required, as the residual pressure from the reverse osmosis units would be sufficient to convey the brine to the discharge point. The draft CCWD Section 404(b)(1) Alternatives Analysis for Meeting Water Quality and Reliability Objectives (Contra Costa Water District 1991) contains additional details regarding brine disposal options.

Rock Slough Pipeline and Pumping Plant

Because the capacity of the Contra Costa Canal between pumping plant no. 1 and pumping plant no. 4 is insufficient to meet the eventual buildout demands of the CCWD planning area, the Rock Slough pumping plant and pipeline would be constructed under this alternative. These facilities would be sized to enlarge the canal's capacity from 350 to 500 cfs.

The Rock Slough pumping plant would be located adjacent and to the south of pumping plant no. 1. The Rock Slough pumping plant site would also contain a small electric substation and appropriate valve and pipeline cleaning structures. The pumping plant would be of open sump construction with a total capacity of 150 cfs, requiring about 3,500 horsepower.

The Rock Slough pipeline would be 66 inches in diameter and would convey water from the Rock Slough pumping plant to a point immediately downstream of pumping plant no. 4. The pipeline would be located generally along the alignment indicated in Figure 2-21.

EBMUD Intertie Pipeline. To provide a portion of CCWD's emergency water supply needs to CCWD customers, the Desalination/EBMUD Emergency Supply Alternative includes a 2.4-mile-long, 48-inch pipeline to convey Mokelumne Aqueduct water to the Contra Costa Canal. This pipeline would connect to the Mokelumne Aqueduct approximately 0.7 mile southwest of the intersection of Lone Tree Way and Empire

Avenue. From this point, the pipeline would run primarily north for 1.7 miles to the Contra Costa Canal at the Neroly blending facility site, following the alignment of Contra Costa County Public Works Department's Lindsey Detention Basin inflow channel.

Construction of Desalination/EBMUD Emergency Supply Alternative Facilities

Desalination Plant

Figure 2-26 shows the primary construction materials that would be used in constructing the desalination plant. Figure 2-26 also illustrates the time frame for construction of the desalination plant and other project components and the source of the construction materials. Approximately 10-150 workers per day would be required onsite over the 24-month period of construction of the plant. These estimates are based on actual staffing data from recently constructed water treatment plants of similar size and on interviews with contractors and construction engineers. Detailed information regarding the construction of this alternative is included in the Stage 2 EIR/EIS Technical Report (bound separately).

MIDDLE RIVER INTAKE/EBMUD EMERGENCY SUPPLY ALTERNATIVE

This alternative is a nonreservoir alternative that would attempt to meet project water quality objectives through construction of a new supplemental intake on Middle River in the Delta. The new intake facilities would have a direct connection to the Contra Costa Canal and would be operated in conjunction with the existing Rock Slough facilities. As with the Desalination/EBMUD Emergency Supply Alternative, a portion of CCWD's reliability objective would be addressed through an agreement with EBMUD for emergency water supplies and construction of an intertie between the Mokelumne Aqueduct and the Contra Costa Canal. The location of these facilities is shown in Figure 2-27.

The facilities that would be required under the Middle River Intake/EBMUD Emergency Supply Alternative include:

- new intake facilities on Middle River and an associated pumping plant on Orwood Tract,
- a Middle River pipeline,
- blending facilities to adequately mix water diverted from Middle River with Contra Costa Canal water, and
- an EBMUD intertie pipeline.

Operation of the Middle River Intake/EBMUD Emergency Supply Alternative

Delta Diversions

As under the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives, CCWD would operate the new intake facilities in conjunction with the existing Rock Slough intake facilities. CCWD would give pumping preference to the diversion location that exhibited the best water quality. This intake would be

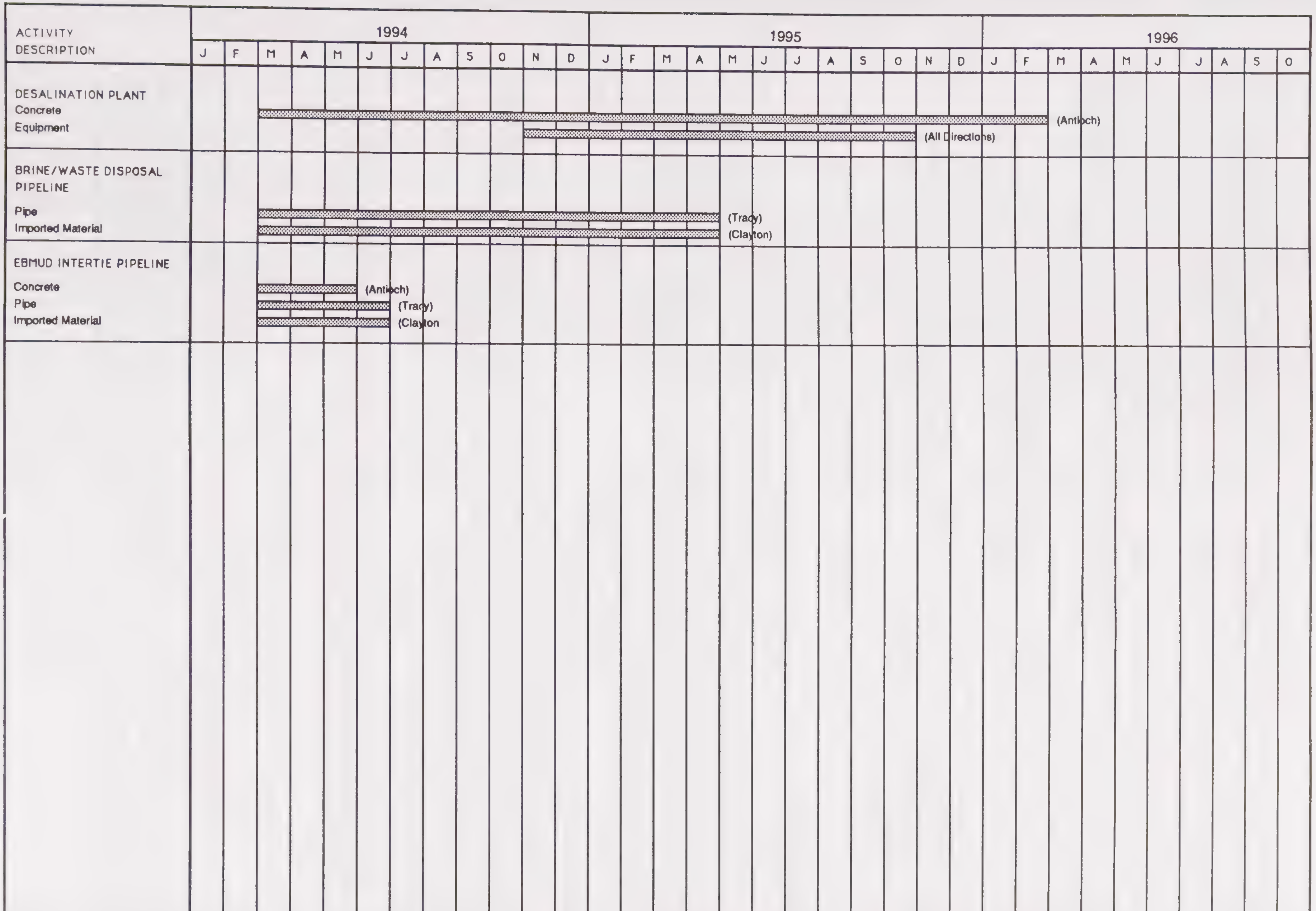


Figure 2-26. Desalination/EBMUD Emergency Supply Alternative - Construction Timing, Materials, and Sources

operated at the maximum design diversion rate and the second intake would be operated at a diversion rate necessary to provide the remainder of the water supplies required to satisfy customer demands. Total diversions from the Delta at buildout of the CCWD planning area would, however, be similar to those described above under "No-Action Alternative" (Figure 2-28). Figure 2-29 schematically illustrates the CCWD water system with the Middle River Intake/EBMUD Emergency Supply Alternative.

The design assumptions for the EBMUD pipeline under this alternative are identical to those described above under "Desalination/EBMUD Emergency Supply Alternative". In the event of a total failure of normal supplies, water consumption would be restricted to domestic and indoor residential needs.

Costs of the Middle River Intake/EBMUD Emergency Supply Alternative

Detailed cost information for this alternative is included in the Stage 2 EIR/EIS Technical Report (bound separately) and is summarized below in the "Summary Comparison of Alternatives" section.

Description of Facilities

Middle River Intake and Orwood Tract Pumping Plant

The Middle River intake would consist of a concrete intake structure and fish screen located on Middle River on the east side of Woodward Island (Figure 2-27). These intake facilities would be connected by a buried, 90-inch pipeline to a pumping plant located on the west side of Orwood Tract on Old River, just south of the Mokelumne Aqueduct. Although the two facilities would be connected by a pipeline, the new pumping plant and intake facilities (including the fish screens) would be similar to those described under "Los Vaqueros Reservoir Alternative".

EBMUD Intertie Pipeline

Connection to EBMUD's Mokelumne Aqueduct would be accomplished by building a partially buried valve structure adjacent to the aqueduct and a short pipeline (approximately 500 feet long) to the Middle River pipeline. The pipeline and valve structure would be sited as indicated in Figure 2-27.

Electric Transmission Lines

Electricity would be supplied to the new intake facility under this alternative from existing WAPA 69-kV or 230-kV transmission lines as described for the Rock Slough/Old River No. 3 configuration above under Los Vaqueros Reservoir Alternative.

Middle River Pipeline

The Middle River pipeline would run west for 2.6 miles from the pumping plant constructed on Old River, crossing Werner-Dredger Cut, as described under the Rock Slough/Old River No. 3 configuration of the Los Vaqueros Reservoir Alternative. From here the pipeline would run west-northwest for approximately 0.7 mile and turn to the west to run adjacent to the Mokelumne Aqueduct. The Middle River pipeline would parallel the Mokelumne Aqueduct for approximately 3.5 miles and turn north-northwest at Sunset Avenue for approximately 0.5 mile. The pipeline would then turn west for approximately 1.3 miles, crossing SR 4,

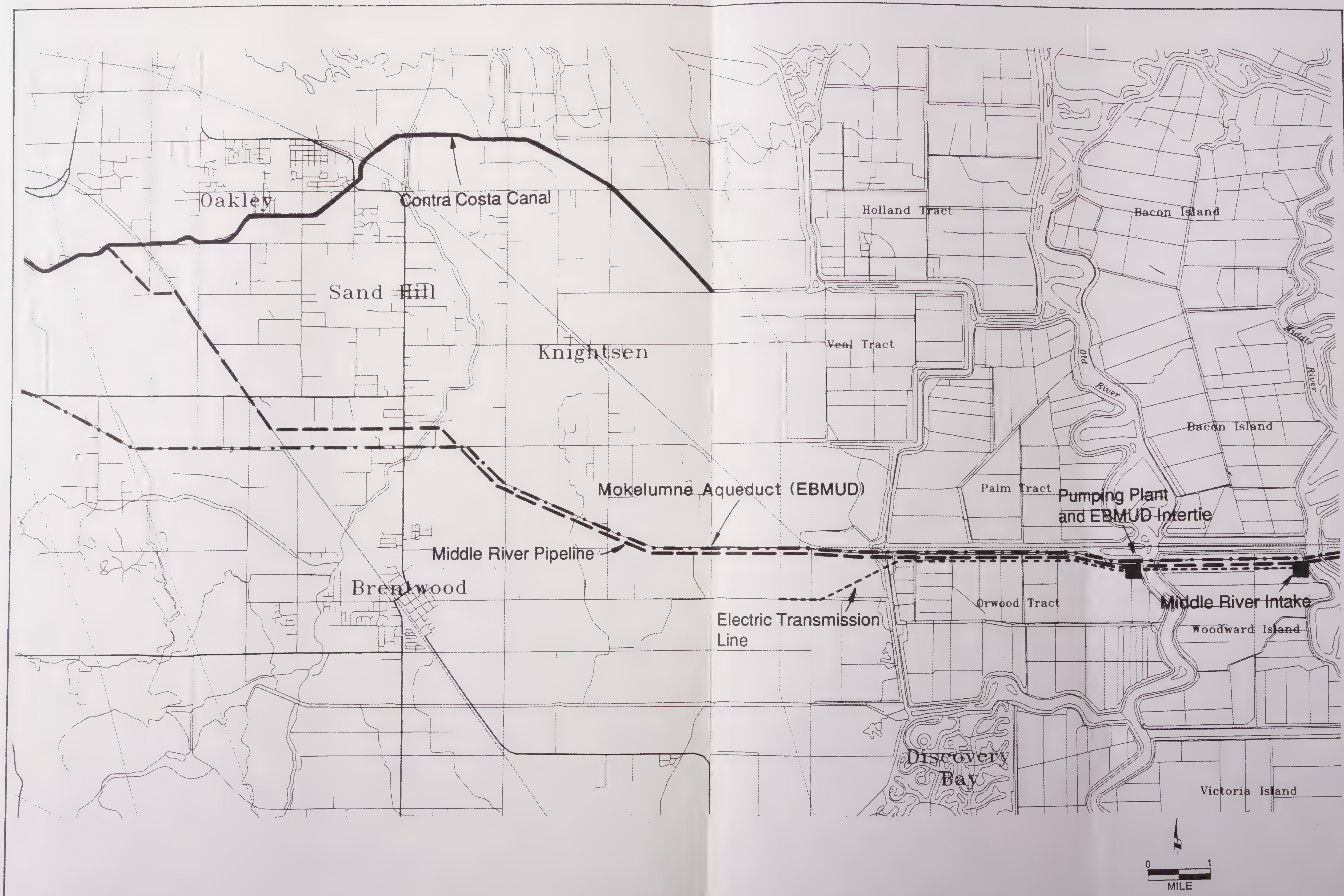


Figure 2-27. Middle River Intake/EBMUD Emergency Supply Alternative

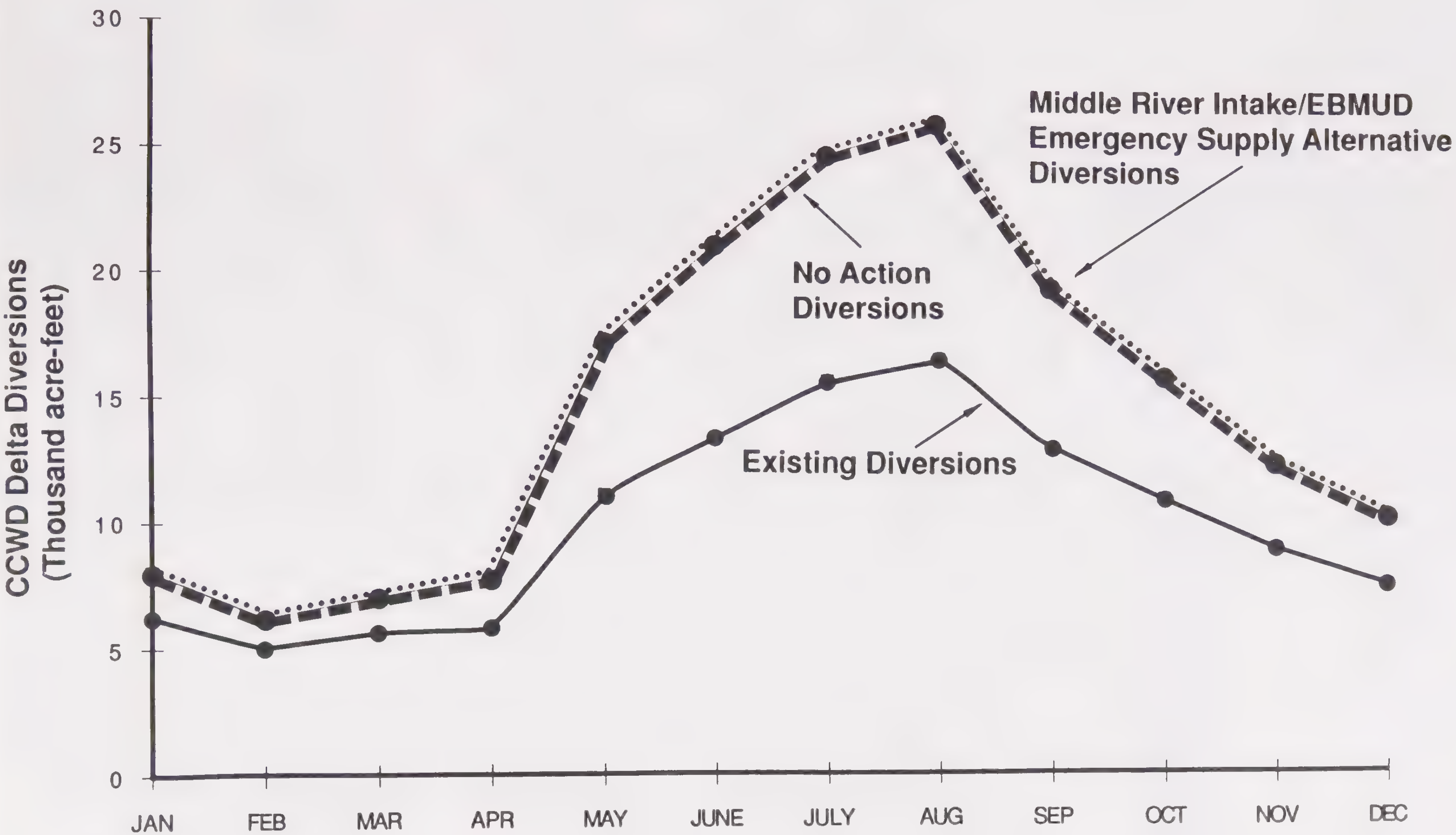


Figure 2-28. Middle River Intake/EBMUD Emergency Supply Alternative Average Monthly Delta Diversions

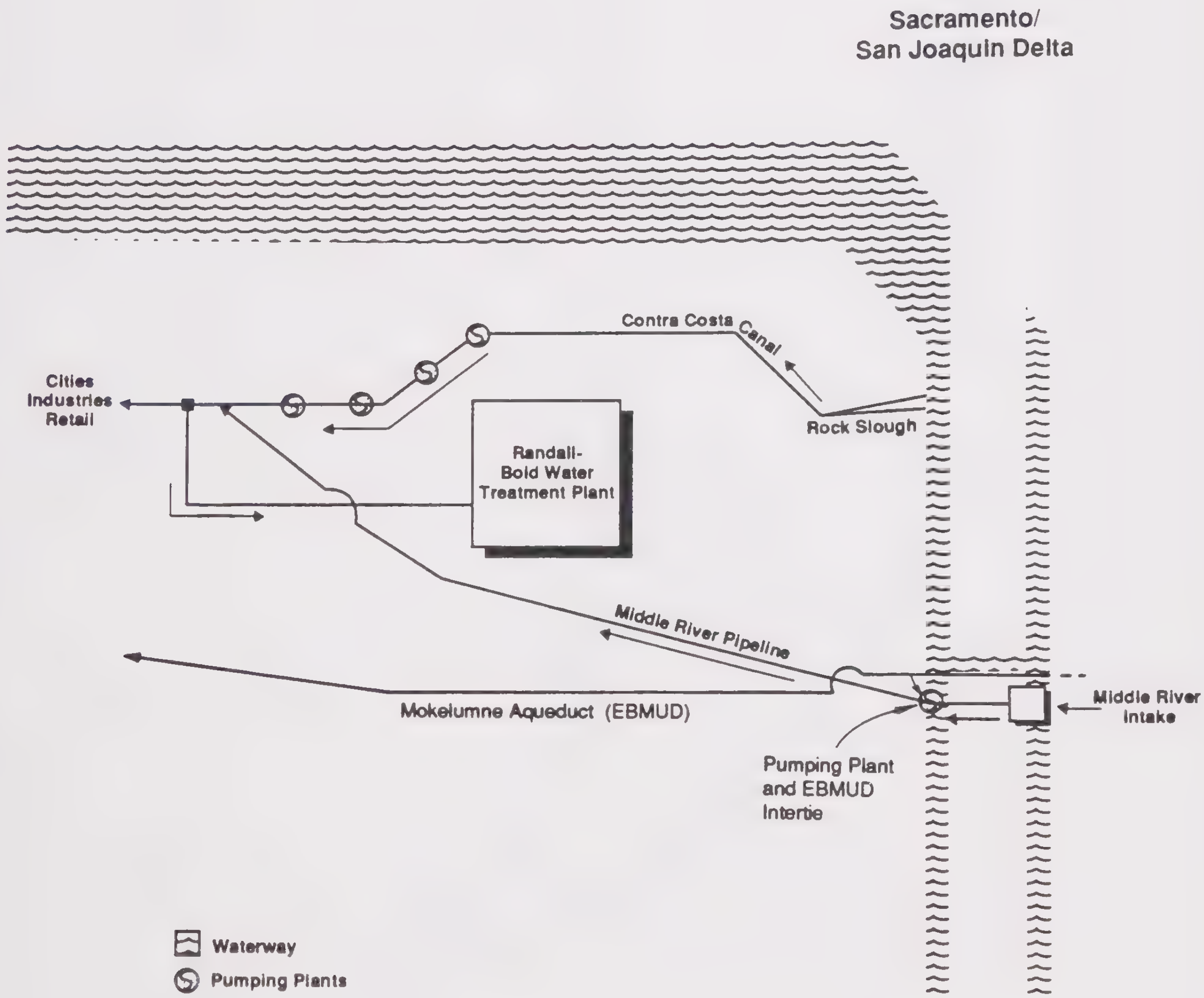


Figure 2-29. Flow Diagram of CCWD Water System with Middle River Intake/EBMUD Emergency Supply Alternative

and turn northwest along the east side of the Southern Pacific Railroad tracks. The pipeline would cross to the west side of the Southern Pacific Railroad tracks 0.3 mile southeast of the intersection of Neroly Road and Empire Avenue and continue to parallel the railroad for approximately 0.6 mile. The pipeline would then turn more sharply west and run cross-country for approximately 1.0 mile to the Neroly blending facilities at the Contra Costa Canal.

Neroly Blending Facilities

The design of the Neroly blending facilities under this alternative is identical to that described above under "Los Vaqueros Reservoir Alternative". However, because this alternative is a nonreservoir alternative and would not employ the Los Vaqueros pipeline, the Middle River pipeline would convey Delta water supplies directly to the Neroly blending facilities.

Construction of Middle River Intake/EBMUD Emergency Supply Alternative Facilities

The Stage 2 EIR/EIS Technical Report (bound separately) provides information regarding construction methods and the amount and transportation of material required to construct this alternative. Figure 2-30 summarizes the type of materials required for the various phases of construction, lists potential sources for each of the materials, and provides information regarding the estimated construction schedule.

Construction of the intake and pumping plant would require a maximum of 50 workers over the 24-month construction period. Construction of the Middle River pipeline would require up to 35 workers during the 19-month construction period.

SUMMARY COMPARISON OF ALTERNATIVES

Table 2-4 presents a summary comparison of the alternatives considered in the Stage 2 EIR/EIS. Table 2-4 focuses on those issues that were generally considered the most important for decision-making purposes. These issues include project costs, water quality performance, reliability (emergency storage) performance, and selected environmental consequences. The discussion below provides a more complete description of the environmental differences between the project alternatives.

Environmental Consequences and Mitigation Measures

Potential environmental impacts that were determined to be significant are listed in Table S-1. Mitigation measures designed to reduce to less-than-significant levels or eliminate significant environmental impacts are also presented, as are unavoidable adverse impacts that would remain even after implementation of the suggested mitigation measures. For most resources, the implementation of suggested mitigation measures would be sufficient to reduce impacts to less-than-significant levels.

CCWD has also tentatively evaluated the potential impacts of increased Reclamation water rates on its projected customer rates. The renegotiation of CCWD's water supply contract with Reclamation may result in increased water rates for CCWD's household, commercial, municipal, and industrial customers. The greatest proportion of costs paid by CCWD customers, however, results from the operation of CCWD's water supply, treatment, and distribution system. Increases in costs to purchase water from Reclamation would have only a minor effect on rates paid by CCWD customers. The effects of these increased costs

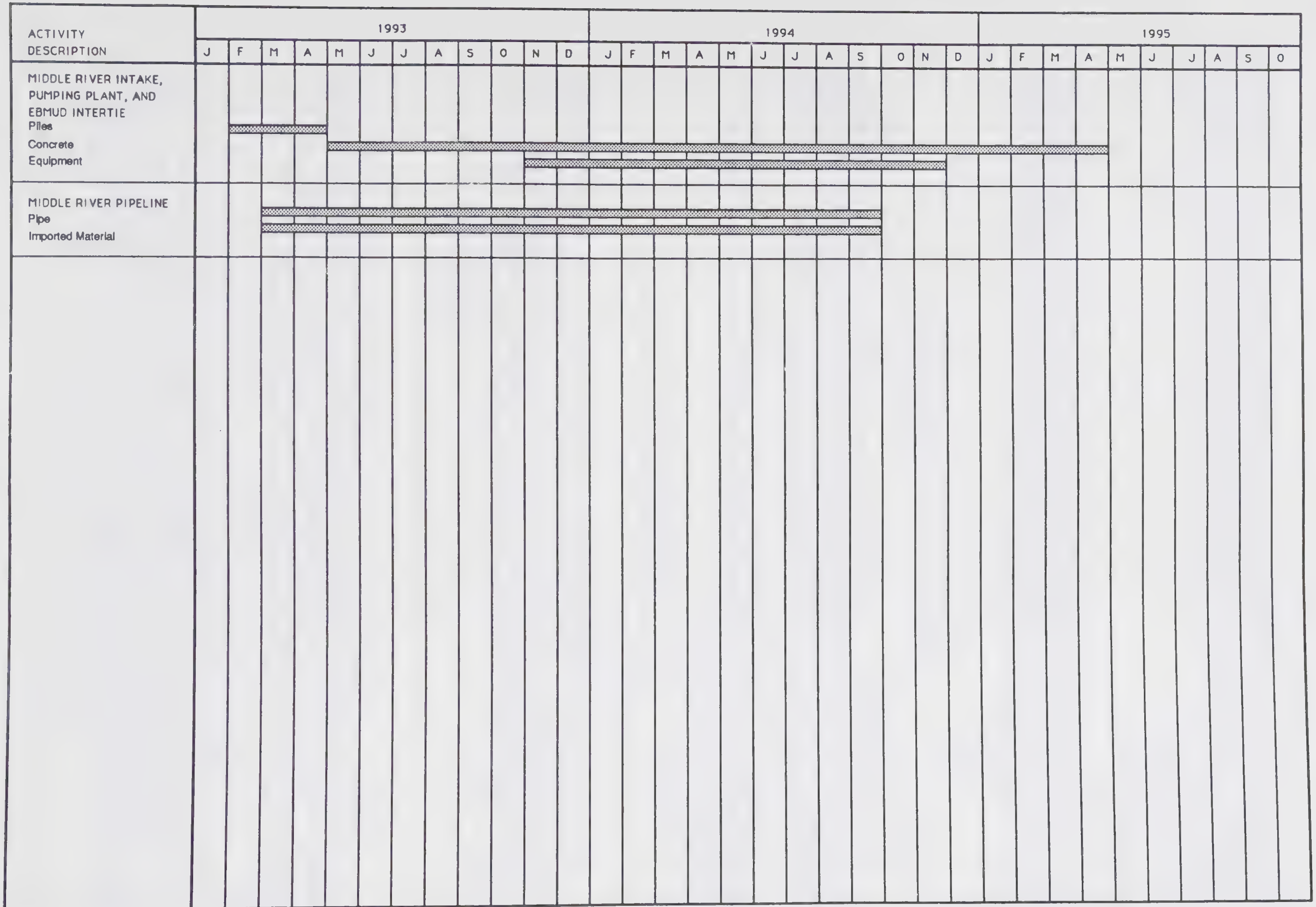


Figure 2-30. Middle River Intake/EBMUD Emergency Supply Alternative - Construction Timing, Materials, and Sources

Table 2-4a. Summary Comparison of Alternatives - Estimated Project Costs (in 1988 Dollars)

Alternative	Total Cost	Capital Cost	Annual Operation, Maintenance, and Replacement Cost	Present Worth of Operation, Maintenance, and Repair Cost[a]
Existing Conditions	NA	NA	NA	NA
No Action	39,671,000	27,360,000	622,000	12,311,000
Los Vaqueros Reservoir				
Rock Slough/Old River No. 1	399,382,000	345,980,000	2,698,000	53,402,000
Rock Slough/Old River No. 2	407,509,000	351,950,000	2,807,000	55,559,000
Rock Slough/Old River No. 3	426,563,000	368,480,000	2,929,000	58,083,000
Rock Slough/Old River No. 4	424,947,000	367,290,000	2,913,000	57,657,000
Rock Slough/Old River No. 5	395,607,000	342,700,000	2,673,000	52,907,000
Rock Slough/Old River No. 6	406,078,000	352,360,000	2,714,000	53,718,000
Rock Slough/Clifton Court Forebay	393,537,000	340,670,000[b]	2,641,000	52,867,000
Kellogg Reservoir	441,693,000	397,198,000	2,248,000	44,495,000
Desalination/EBMUD Emergency Supply	657,597,000	416,380,000	12,187,000	241,217,000
Middle River Intake/EBMUD Emergency Supply	169,317,000	135,115,000	1,728,000	34,202,000

Note: NA = not applicable.

[a] Present worth of annual operations, maintenance, and replacement costs were calculated using a 4% interest rate and 40-year project life.

[b] Does not include possible improvements to Clifton Court Forebay.

Table 2-4b. Summary Comparison of Alternatives - Water Quality

Alternative	Percent of Time Chlorides are Less Than: 65 mg/l	100 mg/l	150 mg/l	200 mg/l	Maximum Number of Consecutive Months Water Quality Goal Not Met
Existing Conditions	59	78	93	97	30
No Action	61	79	92	96	29
Los Vaqueros Reservoir					
Rock Slough/Old River No. 1-6	87	95	98	100	20
Rock Slough/Clifton Court Forebay	92	96	99	100	12
Kellogg Reservoir	87	95	98	100	20
Desalination/EBMUD Emergency Supply	92	97	99	100	8
Middle River Intake/EBMUD Emergency Supply	90	98	100	100	10

Table 2-4c. Summary Comparison of Alternatives - Reliabilty

Alternative	Percent of Time Emergency Storage Is Greater Than: 56,000 af	51,000 af	45,000 af	30,000 af	25,000 af
Existing Conditions	0	0	0	0	0
No Action	0	0	0	0	0
Los Vaqueros Reservoir					
Rock Slough/Old River No. 1-6	84	87	90	94	100
Rock Slough/Clifton Court Forebay	85	87	91	97	100
Kellogg Reservoir	84	87	90	94	100
Desalination/EBMUD Emergency Supply[b]	0	0	0	0	0
Middle River Intake/EBMUD Emergency Supply[b]	0	0	0	0	0

[b] Although an intertie with the EBMUD system would provide some increased system reliability, it could not achieve CCWD's objectives.

Table 2-4d. Summary Comparison of Alternatives - Environmental

Alternative	Total Wetland Acres Affected	Special-Status Plant Species: Number of Species Affected	Special-Status Plant Species: Number of Populations Affected	Special-Status Plant Species: Number of Plants Affected	Wildlife: Acres of Known Occupied Kit Fox Habitat Lost	Wildlife: Number of Threatened or Endangered Species Potentially Affected	Significant Direct Fishery Impacts	Number of Residences Possibly Requiring Relocation	Provision of Substantial Recreational Opportunities	Public Safety	Energy Used during Construction (gallons of diesel fuel)	Energy Used during Operation (kilowatt-hours/year)
Existing Conditions	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	20,287,800
No Action	0	0	0	0	0	0	None	0	No	NA	NA	30,011,700
Los Vaqueros Reservoir												
Rock Slough/Old River No. 1	39.9	2	6	1,900	414	1	None	5	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,147,570	53,927,800
Rock Slough/Old River No. 2	34.5	1	1	1,500	404	1	None	7	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,272,784	49,854,600
Rock Slough/Old River No. 3	20.2	0	0	0	404	1	None	7	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,270,737	49,653,700
Rock Slough/Old River No. 4	29.1	0	0	0	404	1	None	7	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,247,278	49,352,300
Rock Slough/Old River No. 5	19	0	0	0	404	1	None	5	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,172,992	52,155,300
Rock Slough/Old River No. 6	19.5	0	0	0	404	1	None	5	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,189,304	52,958,900
Rock Slough/Clifton Court Forebay	55.1	2	6	1,720	414	1	None	5	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,156,052	50,678,200
Kellogg Reservoir	135.5	3	8	89,444	534	1	None	2	Yes	Decreased Kellogg Creek flooding; slight risk of dam failure (probability less than 0.000001)	2,167,859	49,154,900
Desalination/EBMUD Emergency Supply	6.7	0	0	0	0	3	None	5-15	No	No issues	216,151	62,891,700
Middle River Intake/EBMUD Emergency Supply	0.8	0	0	0	0	1	None	2	No	No issues	355,127	36,147,300

Note: NA = not applicable.

to CCWD ratepayers will be evaluated and communicated to CCWD customers once negotiations between CCWD and Reclamation have reached a stage where such increased water costs can be accurately identified.

ALTERNATIVES CONSIDERED BUT NOT INCLUDED IN DETAILED ANALYSIS

The alternatives considered in this Stage 2 EIR/EIS are directly related to the Section 404(b)(1) alternatives analysis process. As described in greater detail in CCWD's Draft Section 404(b)(1) Alternatives Analysis for Meeting Water Quality and Reliability Objectives (Contra Costa Water District 1991), which is hereby incorporated by reference and available for review at CCWD's offices in Concord, a three-stage screening process is being conducted as part of the alternatives analysis in compliance with the Clean Water Act Section 404(b)(1) guidelines. The first two stages of screening have been completed, in which over 120 possible alternatives were analyzed. Alternatives considered but eliminated in the first two stages of screening are listed in Table 2-5 and generally described in the Stage 2 EIR/EIS Technical Report (bound separately). Alternatives considered in the third stage of screening are being evaluated in detail in this Stage 2 EIR/EIS and are described in the preceding section of this chapter.

CCWD's draft 404(b)(1) alternatives analysis identifies potentially practicable alternatives that can meet CCWD's basic project purpose and describes the environmental impacts associated with each of these potentially practicable alternatives. The geographic scope of the alternatives analysis was confined to California; characteristics used to determine potentially practicable alternatives (i.e., cost, existing technology, and logistics) indirectly define a study area for projects that could meet CCWD's basic project purpose.

CCWD has two related but distinct basic project purposes that must be met for an alternative to be practicable: water quality and water reliability. Table 2-5 provides a comprehensive list of all potential alternatives that, either individually or in combination with other potential alternatives, may meet at least one of the basic project purposes. The alternatives analysis was structured so that potential alternatives were identified and then tested to ascertain their ability to meet each project purpose while adhering to specific cost, existing technology, and logistical criteria. A tiered approach to the alternatives analysis was conducted to most efficiently complete the alternatives selection process. Three stages of evaluation were developed, with each stage resulting in more specific analyses and greater resolution.

The first-stage evaluation was conducted to determine which alternatives or combination of alternatives could potentially meet either the water quality or water reliability basic project purpose. This evaluation eliminated those alternatives that could not reasonably meet either basic project purpose, either separately or in combination with other alternatives (Table 2-5). Environmental impacts were generally considered in conjunction with the other criteria in this phase. This first-stage evaluation did not define practicable alternatives but eliminated those alternatives and combinations of alternatives that could not meet even one of the project objectives.

In the second-stage evaluation, alternatives or combinations of alternatives that met the water quality project purpose were combined with alternatives or combinations of alternatives that met the water reliability project purpose. Evaluation of alternatives at this stage required more detailed analysis because clear and compelling reasons for rejection were not necessarily obvious. The second-stage evaluation, after more detailed analysis, eliminated those alternatives that could not reasonably meet either basic project purpose, either separately or in combination with other alternatives (Table 2-5).

Table 2-5. Evaluation of Potential Alternatives to Meet CCWD's Basic Project Purpose

Alternative	Level of Evaluation[a]		
	First Stage	Second Stage	Third Stage
Delta intake relocation			
Old River No. 2 (1.5 miles south of SR 4)	■		
Old River No. 2 (1,000 feet south of SR 4)	■		
Old River No. 3 (at Mokelumne Aqueduct)	■		
Old River No. 4 (at Indian Slough)	■		
Middle River at Empire Cut	■	■	
Middle River at Woodward Island (diversion to Neroly blending facilities)	■	■	
Middle River with Woodward Island Forebay	■	■	
Clifton Court Forebay	■		
California Aqueduct intake channel	■		
Harvey O. Banks Pumping Plant discharge	■		
Indian Slough	■		
Delta Wetlands Project	■		
Supplemental Delta Intake (with Rock Slough)			
Old River No. 1 (1.5 miles south of SR 4)	■		
Old River No. 2 (1,000 feet south of SR 4)	■		
Old River No. 3 (at Mokelumne Aqueduct)	■		
Old River No. 4 (at Indian Slough)	■		
Middle River at Empire Cut	■	■	
Middle River at Woodward Island (diversion to Neroly blending facilities)	■	■	■
Middle River with Woodward Island Forebay	■	■	
Clifton Court Forebay	■		
California Aqueduct intake channel	■		
Harvey O. Banks Pumping Plant discharge	■		
Indian Slough	■		
Delta Wetlands Project	■		
Sierra supply sources			
Upper American River Basin (with and without Auburn Dam)	■		
Upper Feather River Basin (including Yuba River)	■		
Putah Creek Basin	■		
Sacramento River Basin (including Sacramento River at Hood)	■		
Stanislaus River Basin	■		
Cosumnes River Basin	■		
Mokelumne River Basin	■		
Calaveras River Basin	■		
Groundwater management (conjunctive use)			
East Contra Costa County Basin	■		
Livermore Valley Basin	■	■	
San Joaquin County Basin	■	■	
Sacramento-San Joaquin Delta Basin	■		
Los Vaqueros Reservoir with Delta Intake			
Rock Slough	■		
Old River No. 1 (1.5 miles south of SR 4)	■		
Old River No. 2 (1,000 feet south of SR 4)	■		
Old River No. 3 (at Mokelumne Aqueduct)	■		
Old River No. 4 (at Indian Slough)	■		
Old River No. 5 (1,000 feet south of SR 4)	■		
Old River No. 6 (at Indian Slough)	■		

Table 2-5. Continued

Alternative	Level of Evaluation[a] First Stage	Second Stage	Third Stage
Middle River at Empire Cut	■		
Middle River at EBMUD (diversion to Neroly blending facilities)	■		
Middle River at ECCID	■		
Middle River No. 1	■		
Middle River No. 2	■		
Middle River No. 3	■		
Clifton Court Forebay	■		
California Aqueduct intake channel	■		
Harvey O. Banks Pumping Plant discharge	■		
Indian Slough	■		
Rock Slough and Old River combinations	■	■	■
Rock Slough and Middle River combinations	■		
Rock Slough and Clifton Court Forebay	■	■	■
Delta Wetlands Project	■		
Los Vaqueros Reservoir with non-Delta water source			
Connection to EBMUD water supplies	■		
Sierra supply sources	■		
Raw water interties/exchanges with other water agencies	■		
Groundwater	■		
Other storage reservoir sites			
Kellogg	■	■	■
1. Round Valley; 12. Neroly Road; 23. Kaiser	■		
2. Buckhorn; 13. Alamo Creek; 24. Bolinas			
3. Los Banos Grandes; 14. Pinole; 25. Curry Canyon			
4. Auburn; 15. Upper Pinole; 26. Mitchell			
5. Kirker Creek; 16. Tice Valley; 27. Bailey Road			
6. West; 17. Canada Del Cierbo; 28. Tassjara (high and low)			
7. Nichols; 18. Rodeo Canyon; 29. Doolan Canyon			
8. Sidney; 19. San Leandro; 30. Arroyo Mocho			
9. Morning Side; 20. Cull Canyon; 31. Upper Del Valle			
10. Hillcrest; 21. Bollinger Canyon; 32. Evergreen			
11. Lone Tree; 22. Upper Kaiser			
Desalination processes	■	■	■
Delta management strategies	■		
Bottled water/home treatment devices	■		
Rock Slough intake channel improvements	■		
Delta levee improvements	■		
Standby power	■		
Conservation			
Drought planning	■	■	■
Emergency planning	■	■	■
Overall conservation planning	■	■	■
Water reclamation	■	■	■
Regional water management	■		
Connection to EBMUD water supplies			
Mokelumne River raw water supply	■	■	■
American River raw water supply	■		
Treated water supply	■		

Table 2-5. Continued

Alternative	Level of Evaluation[a] First Stage	Second Stage	Third Stage
Raw water interties/exchanges with other water agencies			
City of San Francisco	▪		
Alameda County Flood Control and Water Conservation District, Zone 7	▪		
Alameda County Water District	▪		
Solano Water Authority	▪		
Marin Municipal Water District	▪		
Santa Clara Valley Water District	▪		
Yuba County Water Agency	▪		
Woodbridge districts	▪		
DWR (SWP)	▪		
Reclamation (CVP)	▪		
Water marketing/exchanges with CVP/SWP contractors	▪		
Los Vaqueros Reservoir Joint Projects			
EBMUD	▪		
DWR	▪		
Reclamation	▪		
Other Participants	▪		
No-Action Alternative	▪	▪	▪

[a] Level of evaluation of each alternative in CCWD's 404(b)(1) alternatives analysis process.

PERMIT, ENVIRONMENTAL REVIEW, AND CONSULTATION REQUIREMENTS

The Stage 2 EIR/EIS is being prepared concurrently with environmental review and consultation required by state and federal environmental laws other than CEQA and NEPA, as required by 40 CFR 1502.25.

Chapter 20, "Consultation and Coordination" contains a preliminary list of federal, state, and local permits that may be required for the proposed action and alternatives. The permit and consultation requirements identified preliminarily in Chapter 20 may change during the Stage 2 EIR/EIS review process as discussions with involved agencies proceed.

ACQUISITION OF LANDS AND COMPENSATION FOR AFFECTED PROPERTY

CCWD recognizes that the various alternatives described in this EIR/EIS would result in the need to remove or relocate various private facilities and to acquire lands currently held in private ownership. CCWD can purchase such facilities and lands by a variety of methods, including negotiation with willing sellers or by exercising its power of eminent domain (commonly called condemnation). CCWD is currently acquiring lands within the Kellogg Creek watershed as part of the Los Vaqueros Project. Acquisitions within the Kellogg Creek watershed were fully discussed in the Stage 1 Environmental Impact Report for the Los Vaqueros/Kellogg Project (Jones & Stokes Associates 1986). The various methods of acquisition are described below. In addition, less-than-fee methods, such as easements, may be used, particularly where direct access for pipeline maintenance and emergency repair would be infrequent or unlikely.

Outright Purchase - Willing Seller

CCWD can negotiate for and purchase lands for project-related uses. CCWD is required by law to offer appropriate compensation based on the appraised value, and set procedures must be followed in the conduct of negotiations. When CCWD seeks to acquire fee title to land that is not already for sale, it is required to offer the full appraised value and to follow set procedures.

Outright Purchase - Eminent Domain

If the landowner and CCWD cannot come to terms, or the landowner does not wish to sell at any price, CCWD may choose to exercise its power of eminent domain and acquire the property through a formal court proceeding. Following a proper showing of the immediate need for the property for a public use, CCWD can obtain an order granting immediate possession of the property, depending on the deposit of the probable compensation for the land to be acquired. At the conclusion of the proceeding, the landowner will be awarded just compensation as determined by the court, based on the evidence presented by the parties to support the various estimates of the value of the property. Either party may appeal the decision.

Compensation for Affected Facilities

In addition to purchasing lands to provide right-of-way for various facilities, CCWD recognizes that various facilities and structures may need to be relocated or compensated for. For example, some structures are located within or adjacent to the water conveyance pipeline rights-of-way for the various alternatives. Various other private residences and buildings may also be affected.

CCWD recognizes its responsibility to provide just compensation for property and facilities acquired for the project that will be ultimately adopted. CCWD will negotiate with owners of such facilities with the intent of replacing such facilities where practicable. Where replacement is not practicable, CCWD will provide appropriate compensation for the facilities. In addition, some residents may require relocation assistance if certain alternatives are implemented. Article 1 of the California Relocation Assistance and Real Property Acquisition Guidelines requires that public agencies assist in finding suitable new housing for residents affected by a project. CCWD recognizes its responsibilities under these regulations.

MITIGATION MEASURES AND ASSEMBLY BILL 3180

This EIR/EIS identifies mitigation measures and also states whether the mitigation measures would reduce significant or potentially significant impacts to less-than-significant levels. Because of recent legislation, mitigation measures adopted by a lead agency need to contain timing and responsibility criteria for implementing mitigation measures. Assembly Bill (AB) 3180, which became effective January 1, 1989, requires the lead agency:

> to adopt a reporting or monitoring program for the changes to the project which it has adopted or made a condition of project approval in order to mitigate or avoid significant effects on the environment. The reporting or monitoring program shall be designed to ensure compliance during project implementation. For those changes which have been required or incorporated into the project at the request of an agency having jurisdiction by law over natural resources affected by the project, that agency shall, if so requested by the lead or responsible agency, prepare and submit a proposed reporting or monitoring program.

A mitigation monitoring plan will be developed by CCWD before a project is adopted. This plan will contain the monitoring and reporting provisions necessary to comply with AB 3180.

Chapter 3. Delta System Hydrodynamics

AFFECTED ENVIRONMENT

Sacramento-San Joaquin Delta

The Delta consists of 700,000 acres of low-lying land at the confluence of the Sacramento and San Joaquin Rivers (Figure 3-1). It is crossed by hundreds of miles of natural and artificial waterways with a total surface area of about 50,000 acres. Much of the land is below sea level and is protected from flooding by 1,100 miles of levees. The most significant beneficial uses of the Delta (agriculture, recreation, and wildlife habitat) depend heavily on flow and water quality in the waterways. Surface water is used to irrigate 520,000 acres of surrounding cropland. Recreational use for boating, fishing, and waterfowl hunting amounts to 12 million user-days annually. Wildlife in the Delta includes over 313 species of animals and 150 species of plants. In addition, a large fraction of California's anadromous fish and migratory waterfowl pass through the Delta (California Department of Water Resources 1987a).

Major water supply projects convey water through the Delta for export to areas generally south of the Delta. Reclamation operates the CVP, and DWR operates the SWP. Reclamation diverts water from the Delta through its Tracy Pumping Plant to the Delta-Mendota Canal, and DWR pumps water for export through the California Aqueduct and South Bay Aqueduct at its Harvey O. Banks Pumping Plant in Clifton Court Forebay. DWR also operates the North Bay Aqueduct, which diverts water at the Barker Slough Pumping Plant.

These major water suppliers divert both natural flow and stored water at their Delta pumping facilities. Their rights to divert the natural flow of upstream rivers and to redivert water stored in their upstream facilities are appropriative, held in the form of conditional permits or licenses from SWRCB. These authorizations contain terms and conditions to protect prior water right holders, including Delta riparian water users, and to protect the public interest in fish and wildlife resources. SWRCB reserves jurisdiction to establish or revise permit or license terms and conditions for purposes of salinity control, protection of fish and wildlife, and coordination of terms and conditions among the major water supply projects.

Over about 30 years, SWRCB decisions have developed permit terms and conditions to protect beneficial uses of Delta water. In 1978, SWRCB adopted D-1485 and the Delta Plan for the Delta and Suisun Marsh. D-1485 modified Reclamation and DWR permits to require the projects to meet water quality standards set in the Delta Plan.

SWRCB implemented a new hearing process, known as the Bay-Delta hearing, to amend the Delta plan. A revised Delta plan may result in amended terms and conditions in the Reclamation and DWR water right permits.

In D-1485, SWRCB commented:

> The complex interaction of Delta inflow, Delta consumptive uses, export diversions, agricultural return flows, and tidal action make it difficult to set, with reasonable accuracy, conditions for the Delta of unlimited duration. In recognition of these facts [SWRCB] and its predecessor reserved continuing jurisdiction in permits affecting Delta water supplies issued to [DWR and Reclamation] for subsequent amendment of conditions.

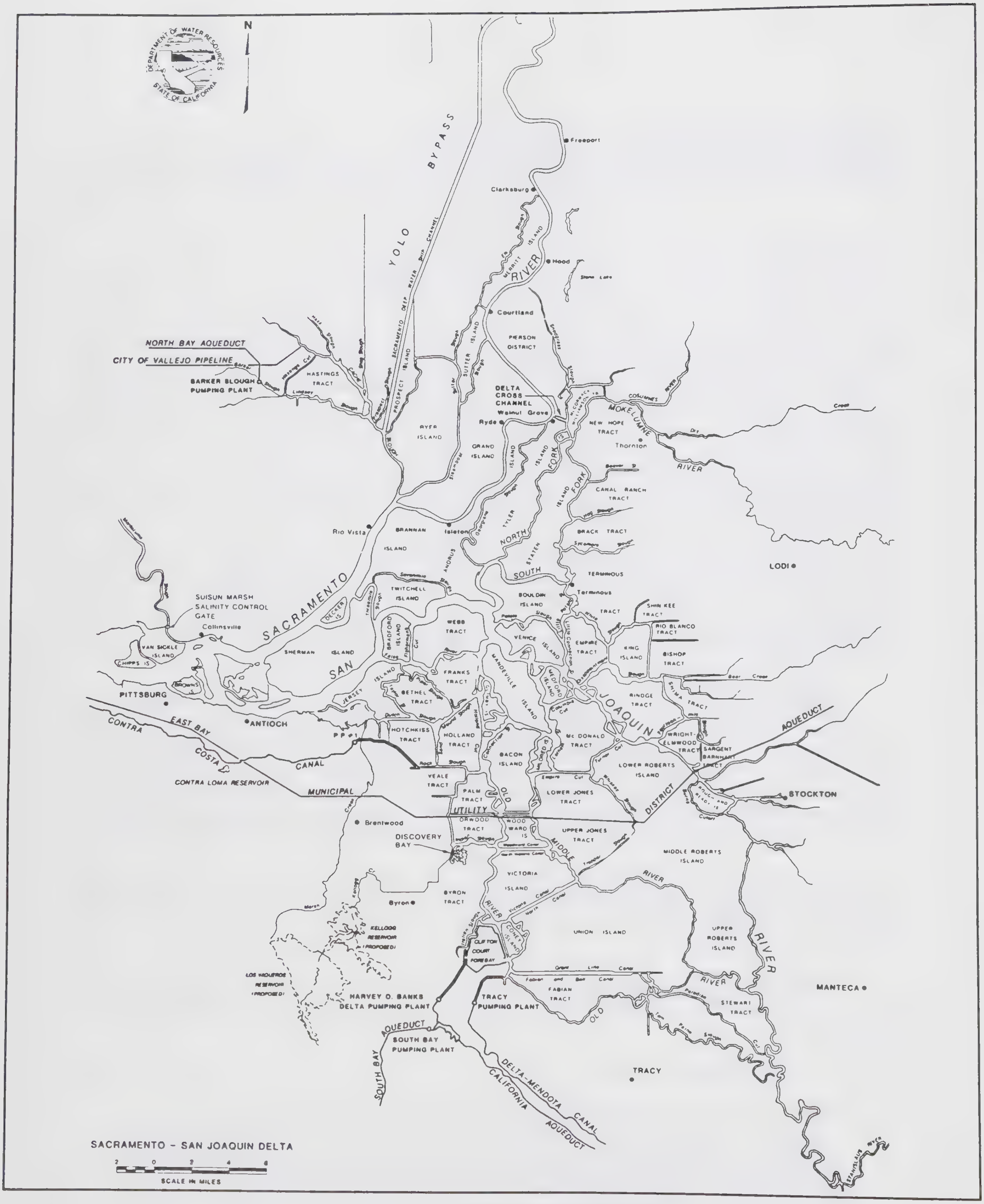


Figure 3-1. Major Water Supply Project Facilities in the Delta

In D-1594, SWRCB began reserving jurisdiction similarly to condition all other permits affecting Delta water supplies. Thus, in terms of regulatory requirements for flow and water quality, the affected environment is constantly changing.

Delta hydrodynamics depend primarily on the physical arrangement of Delta channels, inflow from rivers, export pumping, and tidal action. Delta channels are generally less than 30 feet deep, unless dredged, and vary in width from less than 100 feet to over 1 mile. Riparian vegetation grows along the edges of some channels although most channels are bordered by steep banks of mud or riprapped levees (Kelley 1966, DeHaven and Weinrich 1988). Vegetation is generally removed from channel margins to improve flow and facilitate levee maintenance.

The Sacramento, San Joaquin, and Mokelumne Rivers are the primary contributors to Delta inflow, carrying approximately 82%, 11%, and 3%, respectively, of the total Delta inflow. Rainfall contributes 4%. Although inflow is dependent on hydrological conditions, upstream reservoirs and diversions control inflow volume, timing, frequency, duration, and, in part, quality. Inflow is less controlled during winter and early spring, especially during wet years.

Sacramento River water flows down the main river channel and Steamboat and Sutter Sloughs toward Suisun Bay or through the Delta Cross Channel and Georgiana Slough into the distributaries of the Mokelumne River. Except under high San Joaquin River flow conditions, Sacramento River water also enters the central Delta via Threemile Slough.

Export pumping for CVP and SWP draws water toward the Harvey O. Banks and Tracy Pumping Plants, which, combined, have the ability to divert approximately 11,000 cfs. Except during occasional periods of high runoff, export pumping captures all flow in the San Joaquin River and creates a large southward component of flow across the Delta. Water entering the central and eastern Delta through the Mokelumne and San Joaquin Rivers flows west and south through Middle and Old Rivers toward the export pumps. Typical Delta circulation patterns under conditions of inflows and high export are shown in Figure 3-2.

When export pumping is high relative to Delta outflow, flow in the lower San Joaquin River between Antioch and Jersey Point reverses, carrying a mixture of Suisun Bay and Sacramento River water into the central Delta. This influx of saline water creates water quality problems for agricultural and municipal diverters. The CCWD diversion at Rock Slough is particularly vulnerable to seawater intrusion. Reverse flows also disrupt anadramous fish migration, especially during April through June. To move water southward across the Delta in summer without increasing saltwater intrusion, extra fresh water (carriage water) is released into the Delta to maintain adequate Delta outflow. Typical Delta circulation patterns under conditions of low inflows and high export are shown in Figure 3-3.

Large tidal flows, which reverse direction about four times per day, affect the balance between natural flow, releases to the Delta, and export pumping. Tidal action affects flows, water surface elevations, and current velocities in Delta channels. In the western part of the Delta, tidal flows can be much larger than riverflows. At Jersey Point, for example, monthly average riverflow is less than 8,000 cfs most of the time. In contrast, tidal flows at that location are 100,000 cfs. In general, tidal flows decrease with distance into the Delta, but tide-induced reverse flows in the Sacramento River have been observed as far upstream as Sacramento. The extent of influence depends on the tidal prism volume relative to river discharge at a particular Delta location. Tidal effects are more intense closer to Suisun Bay, but even in the central Delta, water surface elevation can vary more than 5 feet during one tidal cycle. Tidally produced channel velocities can range from -2 to +3 feet per second (fps) or more (with negative figures indicating upstream flood tide flow). High riverflows can cause high velocities in some channel segments. Diversions can increase channel velocities; velocities over 5 fps have been recorded near the CVP Tracy Pumping Plant (Shinmoto pers. comm.).

The salt concentration near Antioch depends on Delta flow patterns and the extent of seawater intrusion, which is affected by prior Delta outflow. Some salt is transported into the central Delta by the tidal

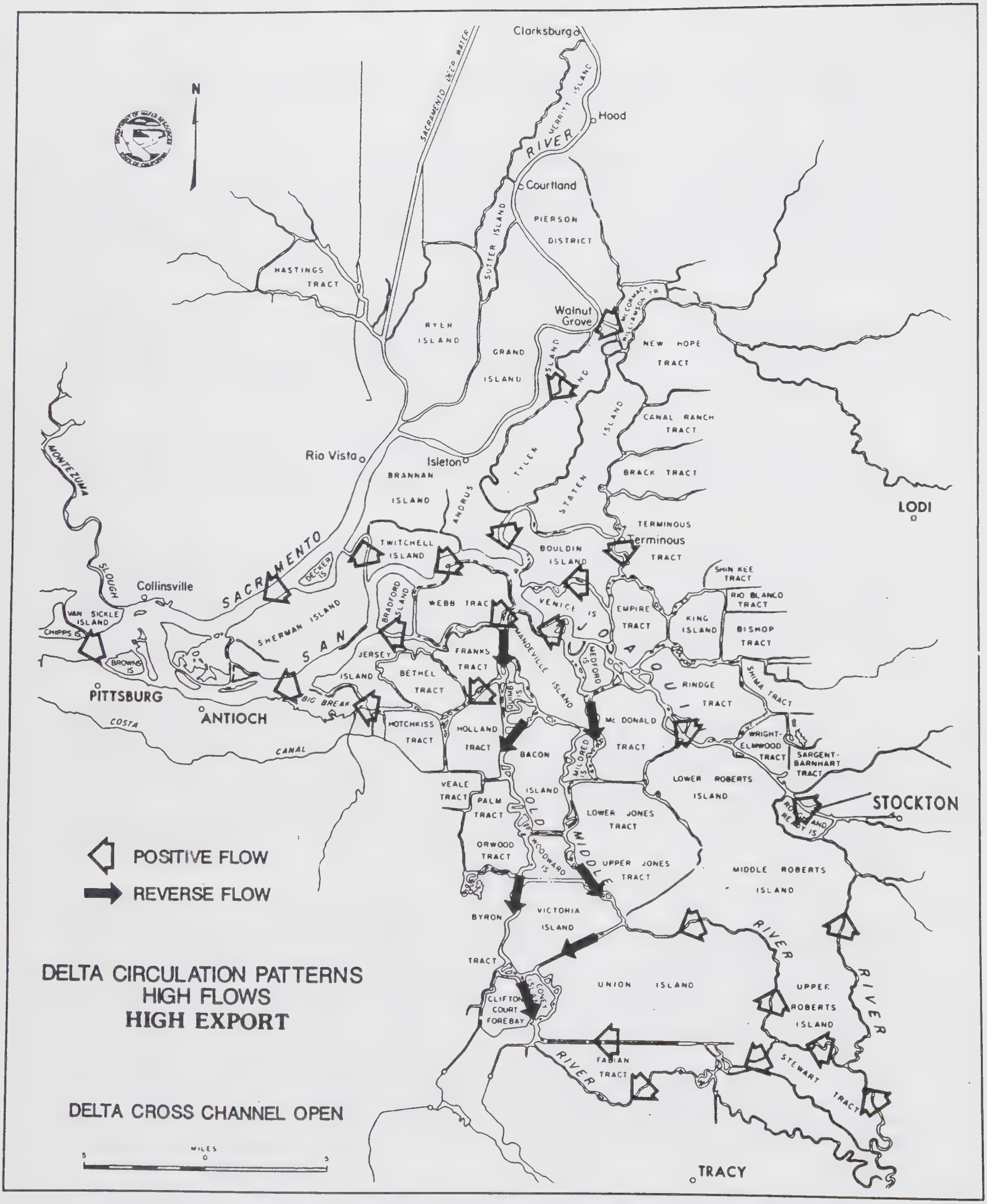


Figure 3-2. Delta Circulation Patterns under Conditions of High Inflows and High Export at SWP and CVP Pumps

Source: DWR 1987j (Exhibit No. DWR-51E)

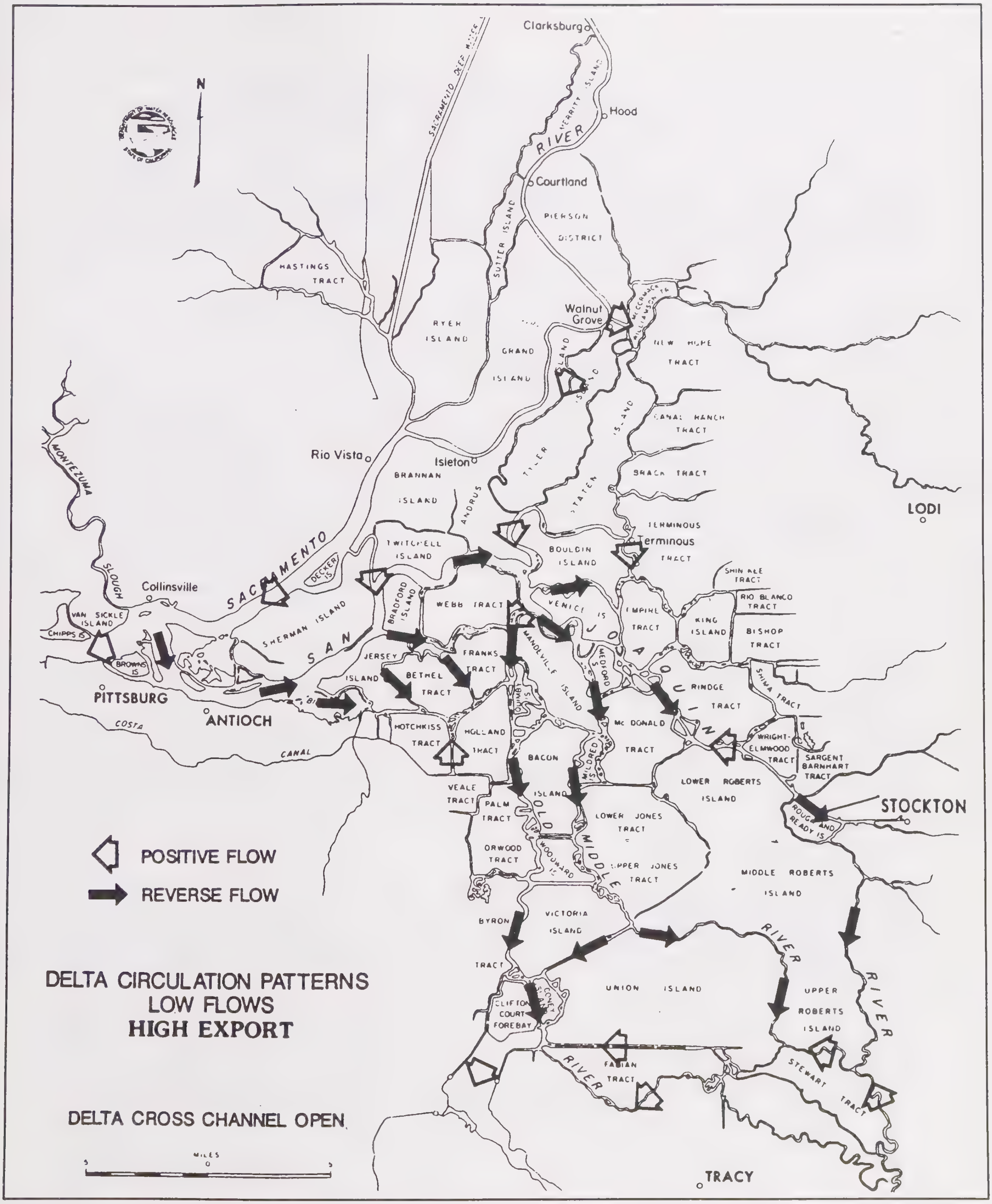


Figure 3-3. Delta Circulation Patterns under Conditions of Low Inflows and High Export at SWP and CVP Pumps

Source: DWR 1987j (Exhibit No. DWR-51D)

flow patterns. Dredging of the San Joaquin River channel has exacerbated seawater intrusion into the Delta. Dredging deepens channels and enables seawater to move further inland than would occur in undredged channels. The relative contribution of these processes to salinity within the Delta can be estimated using a hydrodynamic salt transport model.

During critical years, seawater intrusion has increased salinity upstream to Courtland on the Sacramento River and to Stockton on the San Joaquin River (e.g., 1931, before CVP and SWP export pumps were constructed) (California Department of Water Resources 1987a). Salinity generally increases in a downstream direction, toward the Bay, except in summer in the San Joaquin River above Venice Island, when salinity in the San Joaquin River can be high.

CVP Reservoirs and Waterways

The water diverted by CCWD under the project alternatives will come from unstored Delta flow or storage releases from CVP reservoirs. The reservoirs potentially influenced by the project alternatives are Shasta, Clair Engle, and Folsom Reservoirs. Releases from these reservoirs can influence flow in the Sacramento, American, and Trinity Rivers and Clear Creek.

Generally, these reservoirs store excess water in fall and winter and release the water in summer to meet project water demands.

Simulation of Flow Regimes and Water Budgets

The annual water budget for the Delta varies greatly from year to year because of differences in natural runoff, and it has progressively changed because of new upstream reservoirs and increases in water demand. Computer models that simulate natural runoff, consumptive use, and CVP and SWP operations are commonly used to correct for the variability and trends in the historical record. With these models, flow regimes can be simulated for a long historical period under the assumption that facilities, operating rules, and water demand were constant throughout the period. With this approach, long-term flow statistics can be calculated and flow regimes under alternative sets of conditions can be compared systematically.

CVP/SWP Operations Model

The DWRSIM operations model developed by DWR was used to simulate flows and water budgets for this EIR/EIS. The model simulates flows that would have occurred during 1922-1978 given specified facilities and water demand. The model accounts for runoff from all drainage basins tributary to the Delta and for operation of all major reservoirs and diversions in those drainage basins and the Delta. Calculations are done using a monthly time step.

Simulated riverflow at three locations and simulated storage in Shasta, Folsom, and Clair Engle Reservoirs were evaluated for existing conditions and conditions resulting from each alternative. The flow locations are immediately downstream of these reservoirs: Sacramento River at Keswick Dam, American River at Nimbus Dam, and Trinity River at Lewiston Dam. Flow at these locations is controlled by releases from the reservoirs. Simulated export pumpage, total Delta inflow and Delta outflow were also evaluated.

Delta Hydrodynamics Model

DWRSIM does not simulate flow patterns in the Delta. These flow patterns were simulated using the FDM, a hydrodynamic model of the Delta. FDM represents all channels in the Delta as flow links with hydraulic capacities calculated from the channel geometry, slope, and roughness. Channel junctions are represented as nodes where a mass balance requirement is applied. FDM also simulates salinity in the channels. For boundary flow conditions, FDM uses Delta inflow, outflow, and pumpage obtained from DWRSIM. Although FDM uses a time step of 90 seconds to account for tidal effects, results are averaged for each month to correspond to monthly DWRSIM output. Detailed descriptions of the algorithms, assumptions, and data used in FDM have been prepared by CCWD.

FDM results for flow in the Delta Cross Channel (including Georgiana Slough) and the San Joaquin River at Twitchell Island were selected to evaluate flow conditions within the Delta. The Delta Cross Channel is a constructed channel used to divert water from the Sacramento River to the north fork of the Mokelumne River at the north end of the Delta. Much of the water moved across the Delta by SWP and CVP flows through this channel.

Net flow at Twitchell Island was not obtained directly from the model but was calculated by subtracting simulated net flow in Threemile Slough from simulated net flow in the San Joaquin River at Jersey Point. Twitchell Island is a better location for evaluating the occurrence of net reverse flows in the lower San Joaquin River because positive net outflow at Jersey Point is sometimes sustained entirely by net inflow from Threemile Slough, which enters the river a short distance upstream of Jersey Point. Consequently, net flow at Twitchell Island, which is just upstream of this confluence, can be reversed at times when net flow at Jersey Point is positive. The characterization of net reverse flow is a parameter of the model used to assess impacts on fisheries.

Simulated Flow and Storage Regimes under Existing Conditions

The simulated long-term average annual water budget for the Delta with facilities and demand as they existed in 1990 is indicated by the results of DWR Planning Simulation Study A7. (Table 3-1). Inflow to the Delta averages about 21 million af/yr (Table 3-1). Nearly two-thirds of this water flows from the Delta to the Bay. The remaining third is consumptively used in the Delta or exported from the Delta by the CVP and SWP. During summer, a much larger part of Delta inflow is used in the Delta or for exports. The CVP and SWP are the largest users of Delta water. Exports for these projects are more than four times greater than consumptive use in the Delta. CVP exports include diversions by CCWD, which obtains its water from CVP.

The two largest points of diversion are the SWP Harvey O. Banks Pumping Plant at Clifton Court Forebay and the CVP Tracy Pumping Plant. These plants divert about 15% and 14% of average annual Delta inflow, respectively. CCWD's diversion at Rock Slough is about 0.6% of average annual Delta inflow. Diversions for irrigation on islands in the Delta occur at over 1,800 locations throughout the Delta and are responsible for consumption of about 7.6% of annual Delta inflow. Monthly exports are substantially smaller in May and June than in other months (Figure 3-4).

Large seasonal and year-to-year variations exist in Delta flow conditions. For example, simulated average monthly Delta inflow under 1990 demand conditions ranges from 791,000 af in September to 2.97 million af in February. Similarly, simulated total annual inflow ranges from 8.4 million af to 43.4 million af. In contrast, export demands and D-1485 requirements for Delta outflows are much more uniform and predictable. The variations in Delta flow conditions need to be considered in evaluating the possible effects of the project alternatives.

Table 3-1. Average Annual Delta Water Balance for 1990
Demand Level and 1922-1978 Hydrologic Record

Water Supply Project	Water Volume (thousand af)	Percentage
SWP North Bay Aqueduct	23	0.1
SWP Harvey O. Banks Pumping Plant	3,222	15.5
CVP Contra Costa Canal	119	0.6
CVP Tracy Pumping Plant	2,925	14.1
Delta consumptive use	1,571	7.5
Outflow to the Bay	12,956	62.2
Total	20,816	100.0

Note: Volumes are those predicted by DWRSIM model simulation A7.

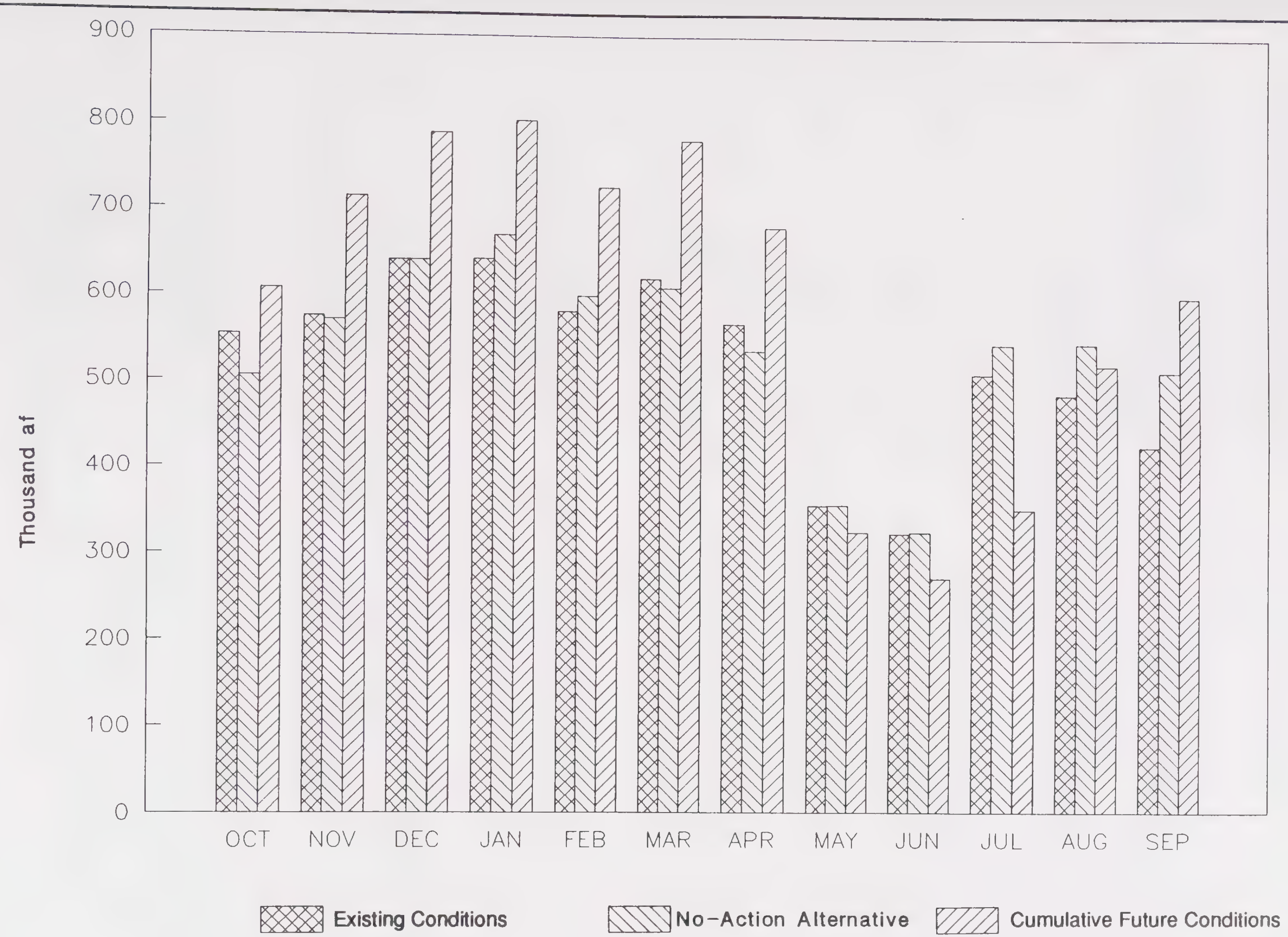


Figure 3-4. Average Monthly (1922-1978) Delta Diversions - CVP, SWP, CCWD

Statistical summaries of simulated monthly flows and storage during 1922-1978 from DWRSIM for each of the selected locations in the Delta and CVP system under existing conditions are included in the Stage 2 EIR/EIS Technical Report (bound separately). Flow or storage was analyzed by month for the 57-year simulation period. Statistics were calculated separately for each month, so the minimum flow for August might not have occurred during the same simulated year as the minimum flow for July.

Delta inflow represents total inflow to the Delta from the Sacramento, San Joaquin, Mokelumne, and Calaveras Rivers and the Yolo Bypass. Based on the simulation, total inflow would range from 449,000 to 12.9 million af/month (af/mo). Minimum flows are much less variable than maximum flows because low flows are highly regulated and include SWP and CVP releases. According to the model, minimum flows would vary by a factor of 1.6 and maximum flows would vary by a factor of 10.

Based on the simulation, Delta outflow would range from 149,000 to 12.2 million af/mo. Outflow would be less than inflow because of the exports from and consumptive use in the Delta; this difference would be fairly constant throughout the year (about 650,000 af/mo).

Based on the simulation, flow in the Delta Cross Channel would range from 178,000 to 949,000 af/mo. Median flow was projected to be largest in July, indicating the influence of SWP and CVP operations. Under the simulation, flow in the Delta Cross Channel was projected to be fairly uniform throughout the year; minimum and maximum monthly flows varied by less than a factor of two.

Based on the simulation, reverse flows in the San Joaquin River at Twitchell Island would be common in all months except May and June (Figure 3-5). Reverse flows would occur 43-61% of the time during October through April and 80-90% of the time in summer.

The storage capacities of Shasta, Folsom, and Clair Engle Reservoirs are 4.55 million, 1.01 million, and 2.45 million af, respectively. According to the simulation, storage in all three reservoirs would reach maximum capacity at least once (during the 1922-1978 simulation period). According to the simulation, minimum storage in the reservoirs would be 720,000, 61,000, and 302,000 af (16%, 6%, and 12% of maximum capacity), respectively. Median storage would be 3.4 million, 750,000, and 1.8 million af, respectively (74% of capacity).

Based on the simulation, monthly flow in the American River at Nimbus Dam would range from 21,000 to 1.28 million af/mo. Because low flows are maintained by releases from Folsom Reservoir, minimum and median monthly flows would vary by less than a factor of three during the year. Median flow would range from 98,000 af/mo in January to 297,000 af/mo in May and maximum flow would be highest in January.

According to the modeling, monthly flow in the Trinity River at Lewiston would range from 8,700 to 348,000 af/mo. Lewiston is located downstream of Lewiston Reservoir, where CVP water stored in Clair Engle Reservoir is diverted to Lake Shasta via the Carr tunnel and powerhouse. Water is released from Lewiston Reservoir into the Trinity River according to a monthly schedule. The simulation indicates that minimum and median monthly flows would vary by less than a factor of three during the year. Median flow would range from 16,400 af/mo in February to 55,000 af/mo in May, and maximum flow would be highest in May.

Monthly flow in the Sacramento River at Keswick Dam would range from 107,000 to 3.23 million af/mo, based on the simulation. Flow at this location is almost entirely regulated by releases from Shasta and Keswick Dams. According to the model, minimum and median monthly flows would vary by a factor of about five during the year. Median flow would range from 230,000 af/mo in January to 932,000 af/mo in July and maximum flow would be highest in January.

Based on the simulation, monthly flow in the Sacramento River at Sacramento would range from 285,000 to 5.68 million af/mo. Minimum and median monthly flow would vary by a factor of less than three

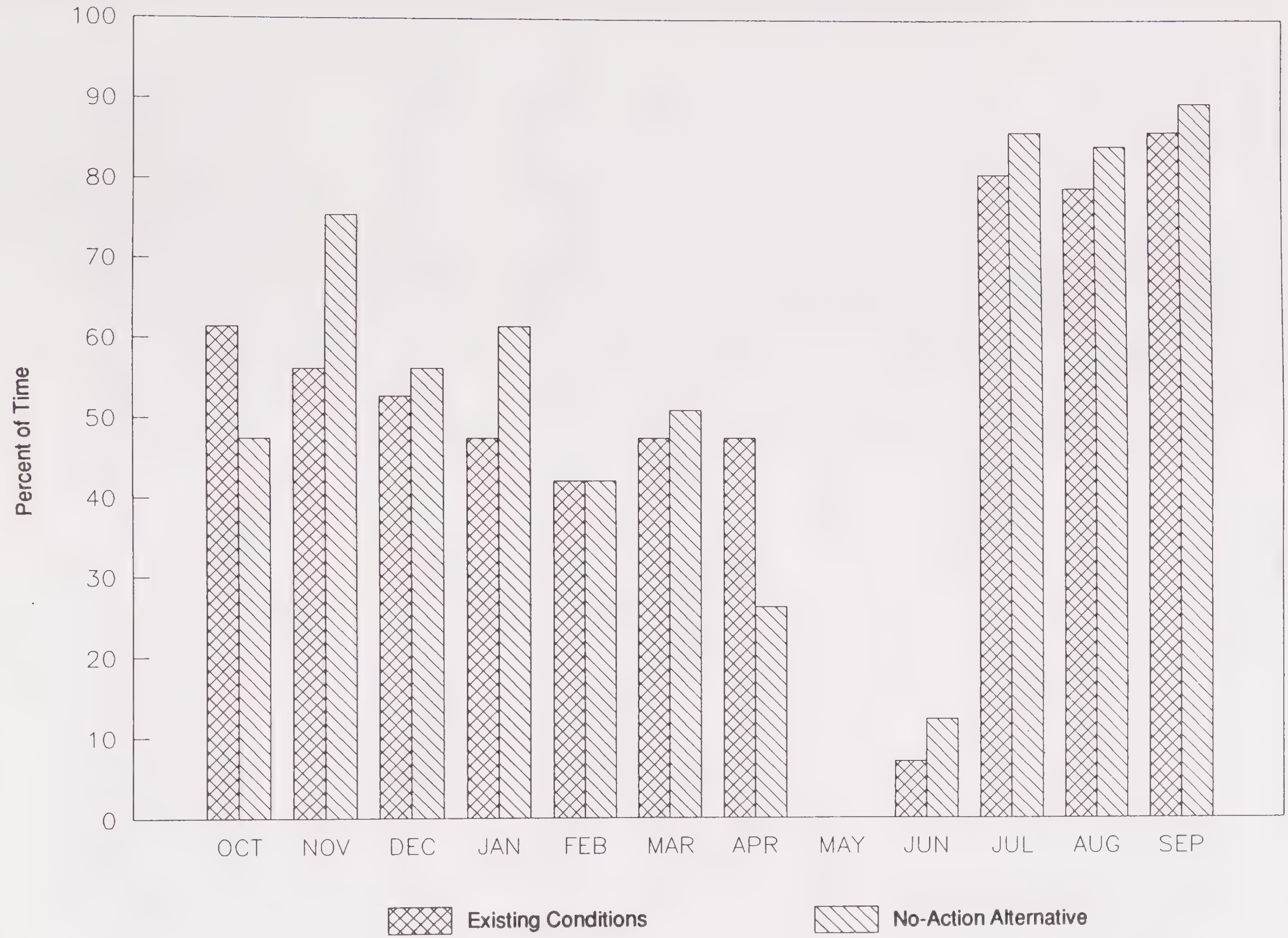


Figure 3-5. Frequency of Reverse Flow in the Lower San Joaquin River - Average Monthly Flows 1922-1978

during the year. Median flow would range from 606,000 af/mo in September to 1.57 million af/mo in February and maximum flow would be highest in January.

Flooding

Flooding is a serious problem in the Delta. Since 1980, 17 tracts or islands, totaling about 58,000 acres, have flooded at least once (California Department of Water Resources 1987a). The flooded areas were scattered throughout the northern and central parts of the Delta. Most of the land in the Delta is below sea level, so flooding can result from levee failure even during low riverflows. Levees are much more likely to fail during periods of high flows, however, and nearly all historical failures have occurred during these periods. The shorelines of the three CVP reservoirs are largely undeveloped. What little development does exist was designed to accommodate the maximum water levels in the reservoirs. All the reservoirs occasionally spill under existing conditions.

A significant flood risk exists along the lower American and Sacramento Rivers near Sacramento. Levees were nearly overtopped by floodflows in February 1986. Although flooding is not presently a problem near Keswick, a significant flood risk exists near Red Bluff, farther south along the Sacramento River.

Sediment Transport

Erosion of levees and deposition of sediment in channels are locally significant problems in the Delta. Erosion problems are greatest in the western part of the Delta, resulting primarily from strong tidal currents. Unlike most river systems, annual erosion rates are inversely related to peak annual riverflows. Low peak flows provide little sediment influx and tidal currents scour sediments from the levees. High peak flows bring large amounts of sediment into the Delta, and much of the erosive energy of tidal currents is expended transporting the fresh sediment.

Ongoing dredging operations in the Delta include maintenance of the Sacramento and Stockton deep-water ship channels and local dredging to obtain material for levee repair and improvements. The Corps dredges annual averages of about 160,000 and 450,000 cu yds of sediment from the Stockton and Sacramento ship channels, respectively. Sediment accumulation is particularly rapid during large floods.

Bank erosion is a problem along the upper Sacramento River, but is not generally a problem in the other rivers. Deposition of sediment is not a problem in any of the rivers. Large changes in flow regime, particularly large increases or decreases in peak flows, could change the sediment transport capacity of the rivers and initiate erosion or deposition.

Groundwater Conditions

Because the land surface on most Delta islands is below the level of the water surface in the adjacent channels, water tends to seep through the levees and saturate soils in the island interiors. Although this seepage provides a convenient source of irrigation water, drainage ditches and sump pumps are required to dewater the soils between irrigation periods. Seepage rates and dewatering costs increase as the elevation difference between the channel surface and island interior increases. Seepage processes are relatively slow, however, and do not respond measurably to short-term fluctuations in channel flow.

The Sacramento and American Rivers serve as sources and drains for groundwater in the Sacramento Valley. The rate and direction of seepage between the rivers and groundwater basin vary with the river stage, which varies much less than riverflow. Furthermore, seepage through the riverbed and aquifers rapidly diminishes short-term water level fluctuations. As a result, the small changes in riverflow resulting from the alternatives would not cause significant changes in groundwater levels or rates of recharge or discharge.

ENVIRONMENTAL CONSEQUENCES

Methodology

The DWRSIM and FDM models were used to evaluate existing flow and storage regimes and flow and storage regimes resulting from each project alternative under present and future demand conditions. Detailed descriptions of assumptions and data used to represent each set of conditions were prepared by CCWD (1990, 1991). Existing conditions consist of the facilities, water supply demand, and operational rules that existed in 1990. Average annual CCWD diversions at Rock Slough are 119,000 af, and average annual CVP and SWP exports from the Delta total 6.15 million af. Future conditions consist of existing facilities operated to meet increased demand. Although CVP and SWP demands increase to 7.2 million af, average annual CVP and SWP exports total 6.23 million af, and CCWD diversions average 176,000 af, under future conditions. Although annual average Delta export and CCWD diversions would increase by only about 127,000 af under future conditions, the total average annual reduction in Delta outflow would be 688,000 af. This reduction in outflow is largely attributable to increased water use in the rivers upstream, which would reduce Delta inflow.

Future cumulative conditions include operation of proposed CVP and SWP facilities, including Los Banos Grandes Reservoir, the Kern Water Bank, the North Delta and South Delta Water Management Programs, and increased pumping capacity at the Harvey O. Banks Pumping Plant. Demand conditions are for 2035 and include annual CVP and SWP exports totaling 6.98 million af. Only one model simulation was run for future cumulative conditions: a DWRSIM simulation of the No-Action Alternative. Flow regimes in the Delta and for the other alternatives were inferred from flow relationships under future conditions. Existing, future, and future cumulative conditions were represented in DWRSIM simulations A7, 543, and 473, respectively.

Criteria for Conclusions of Significance

Delta and CVP Facilities

In this analysis, changes in flow regime alone would not be significant impacts. These changes, however, could have significant impacts on water quality, aquatic wildlife, flooding, sediment transport, and groundwater conditions. Analyses of impacts on water quality and aquatic wildlife are presented in separate chapters. This chapter presents impacts on flooding, sediment transport, and groundwater.

The discussion of hydrologic impacts focuses on a comparison of the flow or storage regime under each alternative with existing conditions. This comparison was repeated for present and future demand conditions. Because most of the differences between the existing flow regime and future alternative flow regimes result from changes in CVP and SWP operations unrelated to the alternatives, future flow regimes under each alternative were also compared with future No-Action Alternative flow regimes. This comparison reveals the extent to which future changes are attributable to the alternatives as opposed to other factors.

Changes in flow regime are described using selected statistical characteristics of simulated monthly flows. These changes are tabulated for 10 locations under both present and future demand conditions in the Stage 2 EIR/EIS Technical Report (bound separately). Separate statistical summaries are shown for each month of the year and include the minimum, median, average, and maximum flows in each month for the 57-year simulation period. Also shown are the frequencies and magnitudes of increases and decreases as compared to existing conditions.

For CVP reservoirs, comparisons are made of storage rather than flow regime. Storage in September is often the minimum storage in each year and was selected for analysis because many storage-related environmental impacts are greatest at low storage levels.

Fisheries and aquatic habitat are particularly sensitive to changes in minimum flows and flooding and sediment transport are most affected by maximum flows. Peak flows or maximum daily flows cannot be estimated precisely for the Delta and CVP facilities because DWRSIM uses monthly time steps. Peak storm flows often last for only a few days in the Delta and major rivers, so peak flows are considerably higher than monthly average flows. This analysis, nevertheless, conservatively assumes that any increase in the peak monthly average flow would be associated with an increase in the peak flow occurring in that month.

Most effects of the alternatives on flow regime and storage in the Delta and CVP facilities are less than significant. Slight differences between simulated flow regimes for different alternatives must be interpreted with caution for several reasons. First, the models operate the system differently from the way the system is operated in reality. For example, transient changes in salinity in the Delta might not be detected immediately and a variable amount of time might elapse before reservoir releases are changed in response. Second, the operations rules might not be followed as rigorously as they are in the models. For example, CVP operators might decide to release water from Shasta Reservoir instead of Folsom Reservoir, or vary pumping or release rates on a daily, rather than monthly, basis because of variations in local conditions, maintenance needs, or mechanical problems. Third, small changes in model input or in CCWD diversions might trigger changes in reservoir operations because of thresholds in the operations algorithms. For example, a change in the amount of CCWD diversions from the Delta might change salinity at Jersey Point enough to trigger an operational response (such as a reservoir release) that would not have occurred if the change had been infinitesimally smaller.

Finally, DWRSIM implicitly assumes that climatic, hydrologic, and water use conditions in the future, including sequences of wet and dry conditions, will be the same as those that occurred during 1922-1978. The sequence of hydrologic conditions during the historical period will not be exactly repeated. As long as the basic statistical characteristics of rainfall, streamflow, and water use remain the same, however, the models provide a basis for comparing the effects of different alternatives and indicate the probabilities of the alternatives' hydrologic consequences. In view of these limitations, differences between flow regimes of less than 1% or 2% would be less than significant and are not described in detail.

The effects of the alternatives on groundwater conditions in the Delta and near CVP facilities would be less than significant because simulated flows did not decrease to zero in any waterways as a result of any alternative; most flow changes were small (seepage rates out of rivers and channels are proportionately smaller than changes in flow); and decreased flow in 1 month was often followed by increased flow in the next, and these changes would tend to average out as they are attenuated by seepage processes.

The effects of the alternatives on water surface elevations in the Delta would also be less than significant. FDM simulation results indicate that changes in water surface elevation at the various alternative intake sites, where water level changes would be the greatest, would be less than 0.01 foot. This magnitude of change is generally imperceptible.

No-Action Alternative

Annual exports from the Delta in normal years would increase by about 127,000 af, or 2%. On average, decreases would occur in some months and increases would occur in others, especially July through September (Figure 3-4). Total CCWD diversions from the Delta would increase in all months, when measured as physical quantity or percentage of total exports (Figures 3-6 and 3-7).

Flow Regime. Statistical summaries of simulated monthly flows in the Delta are listed in the Stage 2 EIR/EIS Technical Report (bound separately). Under future conditions, CVP reservoirs would be operated to meet increased future demands, and more water would be transferred across the Delta. Delta inflow would be different than under existing conditions 98% of the time, and increases or decreases greater than 10% would occur 30% of the time (Figure 3-8). Based on the simulation, increases would be most frequent during June through September, and decreases would be most frequent during October through February. Based on the simulations, Delta inflow would be smaller than under existing conditions in October through June, primarily as a result of the greater available reservoir storage used to capture high flows. Minimum Delta inflow would decrease in March through August and in November by 32,000-93,000 af/mo (6-18%). The lowest minimum flow (in October), however, would increase by 13,000 af/mo (3%).

Under simulated conditions, Delta outflows would remain unchanged more of the time than Delta inflows (Figure 3-9). Decreases in inflows would be more frequent than increases in inflows because of the overall increase in Delta exports. In the simulations, minimum Delta outflows were unchanged in almost all months, however, probably because salinity standards mandated under D-1485 constrain minimum Delta outflows. Decreases in inflows would be relatively frequent in winter and infrequent in summer. Increases would be more frequent than decreases in July through September.

The pattern of changes in simulated flows in the Delta Cross Channel would be similar to the pattern for Delta inflow (Figure 3-10). Based on simulation, flow would almost never be the same as under existing conditions, and changes of greater than 10% would occur about 30% of the time. Minimum flows would be smaller than under existing conditions in November through March and May through July by 10,000 to 24,000 af/mo (2% to 9%). The largest decrease would be in March and median and average flows would decrease primarily between October and May and increase between June and September.

Reverse flows in the lower San Joaquin River would be more frequent than under existing conditions during 8 months of the year, although the general seasonal pattern would not change (Figure 3-5).

In the simulation, all three reservoirs were operated to meet the higher demand on the CVP system. Based on the simulation, average storage would be less in all the reservoirs in every month of the year under the No-Action Alternative. All three reservoirs spilled at least once during the 57-year simulation period, however. Clair Engle Reservoir would be the least affected in terms of changes in average and high storage levels. Minimum storage would be lower in all reservoirs in every month of the year. Based on modeling, the minimum storage would decrease in Shasta Reservoir from 720,000 to 347,000 af (from 16% to 8% of capacity), in Folsom Reservoir from 61,000 to 1,000 af (from 6% to 1% of capacity), and in Clair Engle Reservoir from 302,000 to 87,000 af (from 12% to 4% of capacity). Substantial, frequent changes in September storage would occur in all three reservoirs (Figure 3-11). Folsom Reservoir would be most affected, where increases would occur in 4 of the 57 years and decreases of over 15% would occur in most years.

Based on the simulation, changes in the flow regime in the Sacramento River at Keswick Dam would be similar to the changes in Delta inflow, with decreases in average flows occurring in all months except late summer and decreases occurring in summer. Flows would remain unchanged more of the time, however (Figure 3-12). Based on modeling, changes greater than 10% would occur about 25% of the time. Minimum flows would decrease by 29,000 af/mo (7%) in June. The flow regime in the Trinity River at Lewiston would

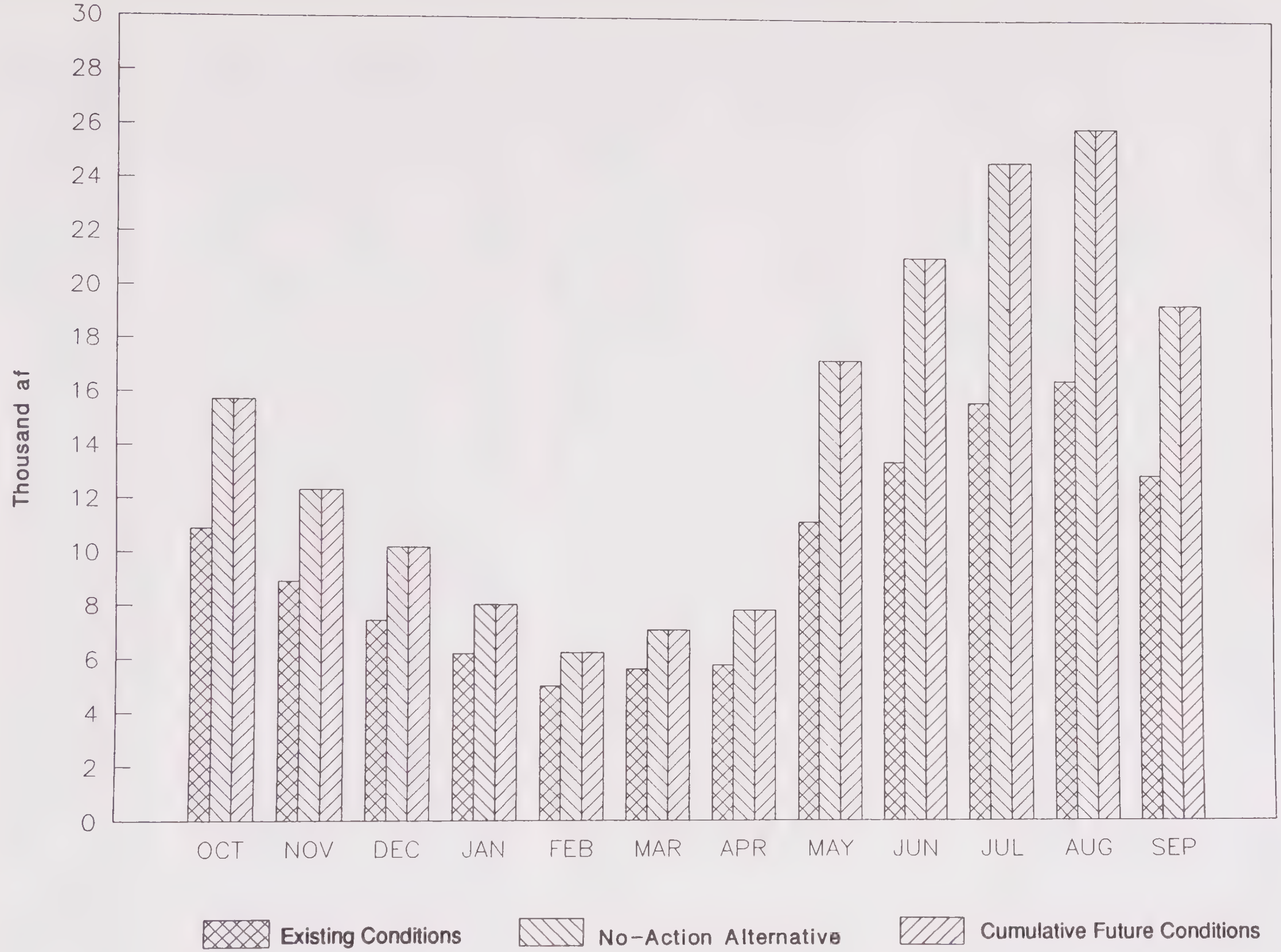


Figure 3-6. Average Monthly (1922-1978) CCWD Diversions

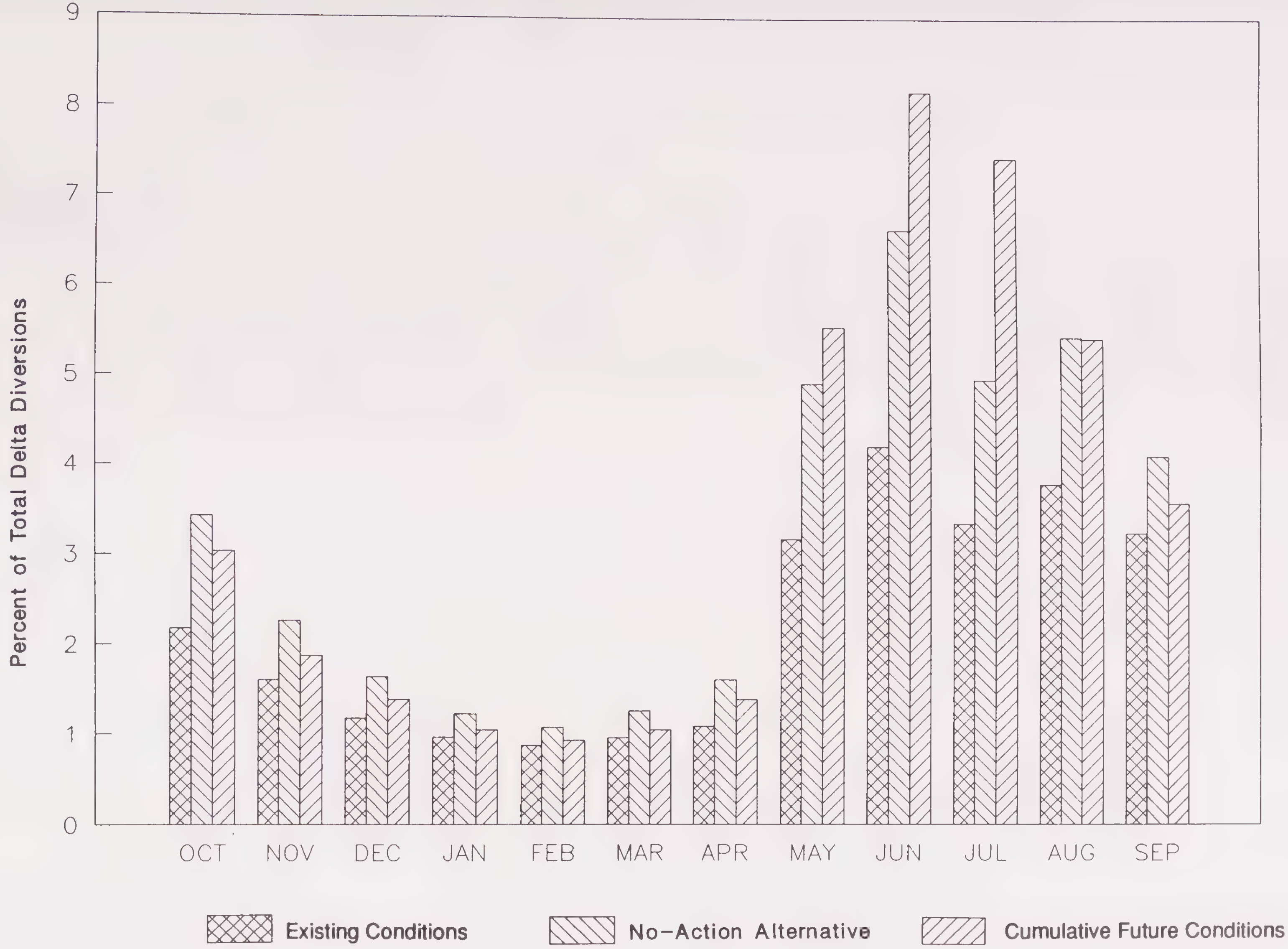


Figure 3-7. CCWD Average Monthly (1922-1978) Delta Diversions as a Percentage of Total Delta Diversions

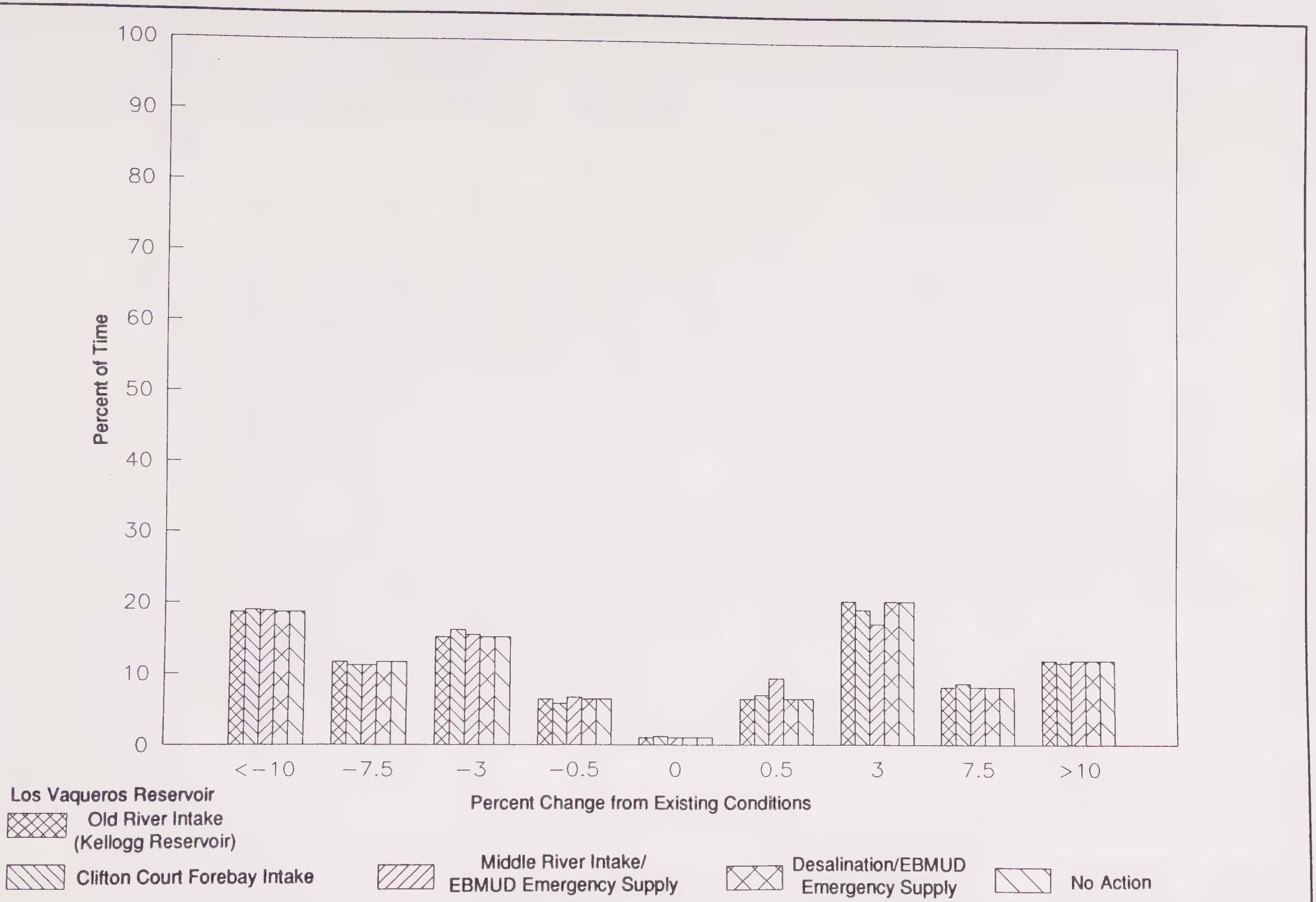


Figure 3-8. Frequency of Changes in Monthly Delta Inflow under the Alternatives under Future Conditions

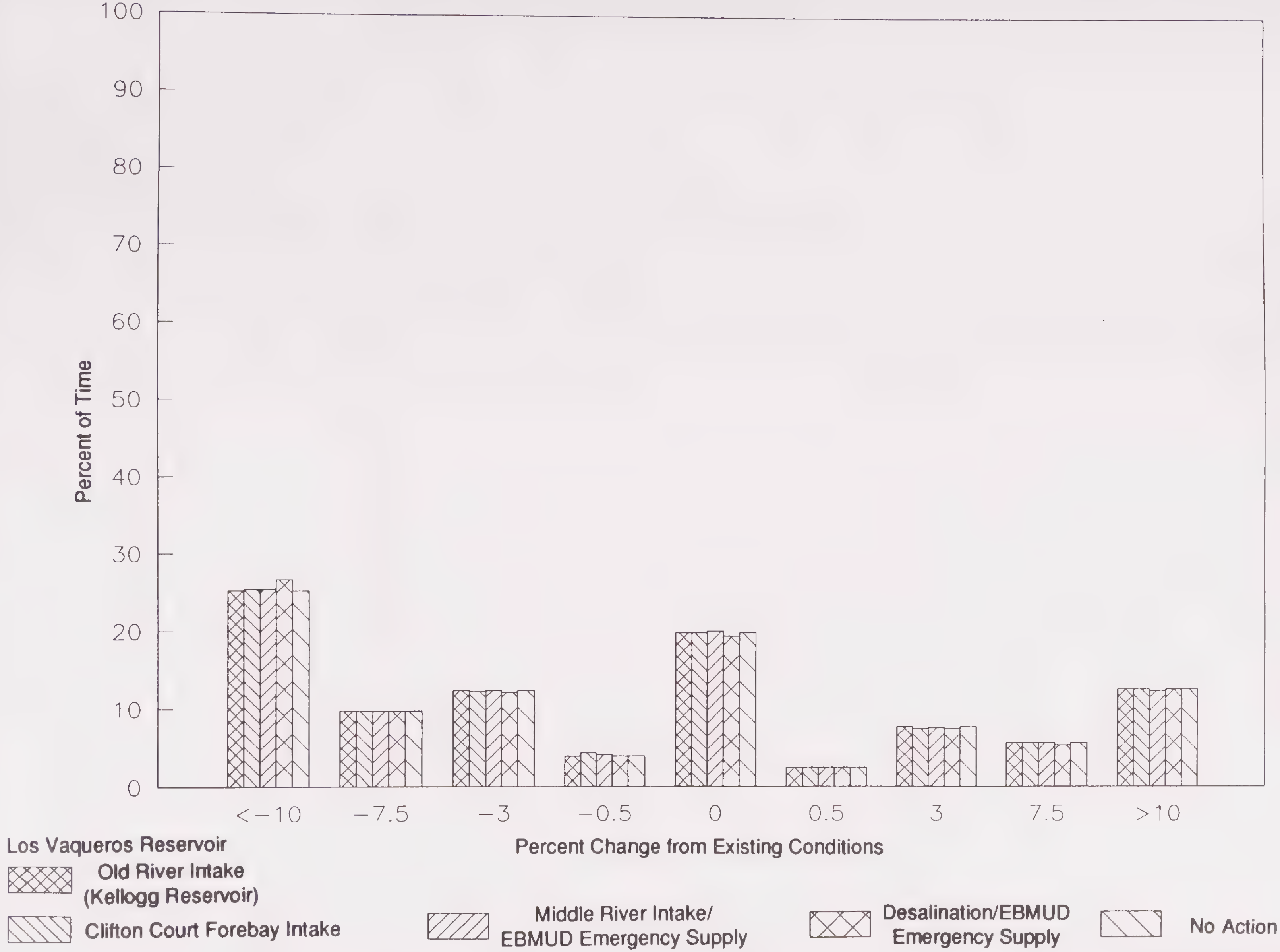


Figure 3-9. Frequency of Changes in Monthly Delta Outflow under the Alternatives under Future Conditions

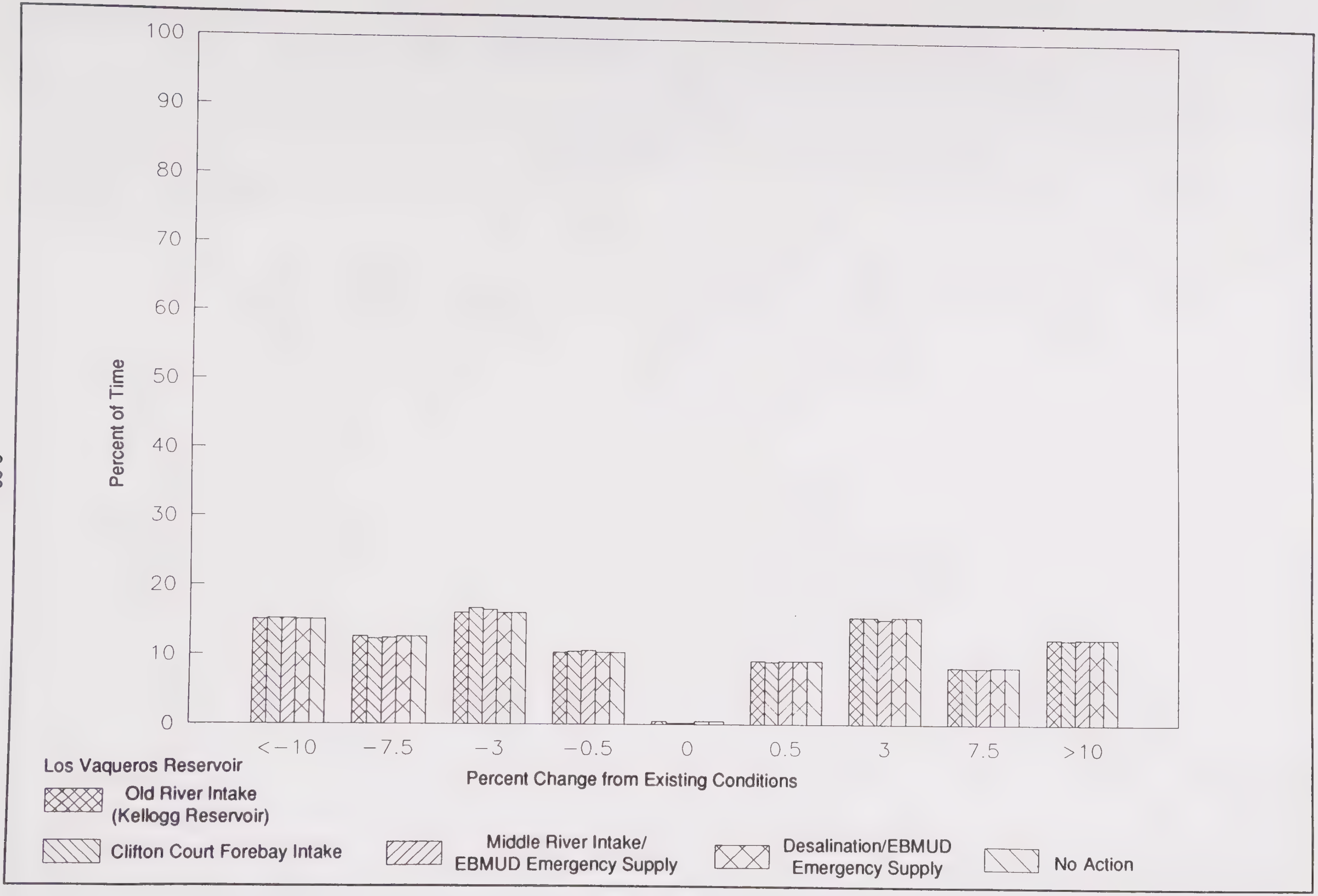


Figure 3-10. Frequency of Changes in Monthly Delta Cross Channel Flows under the Alternatives under Future Conditions

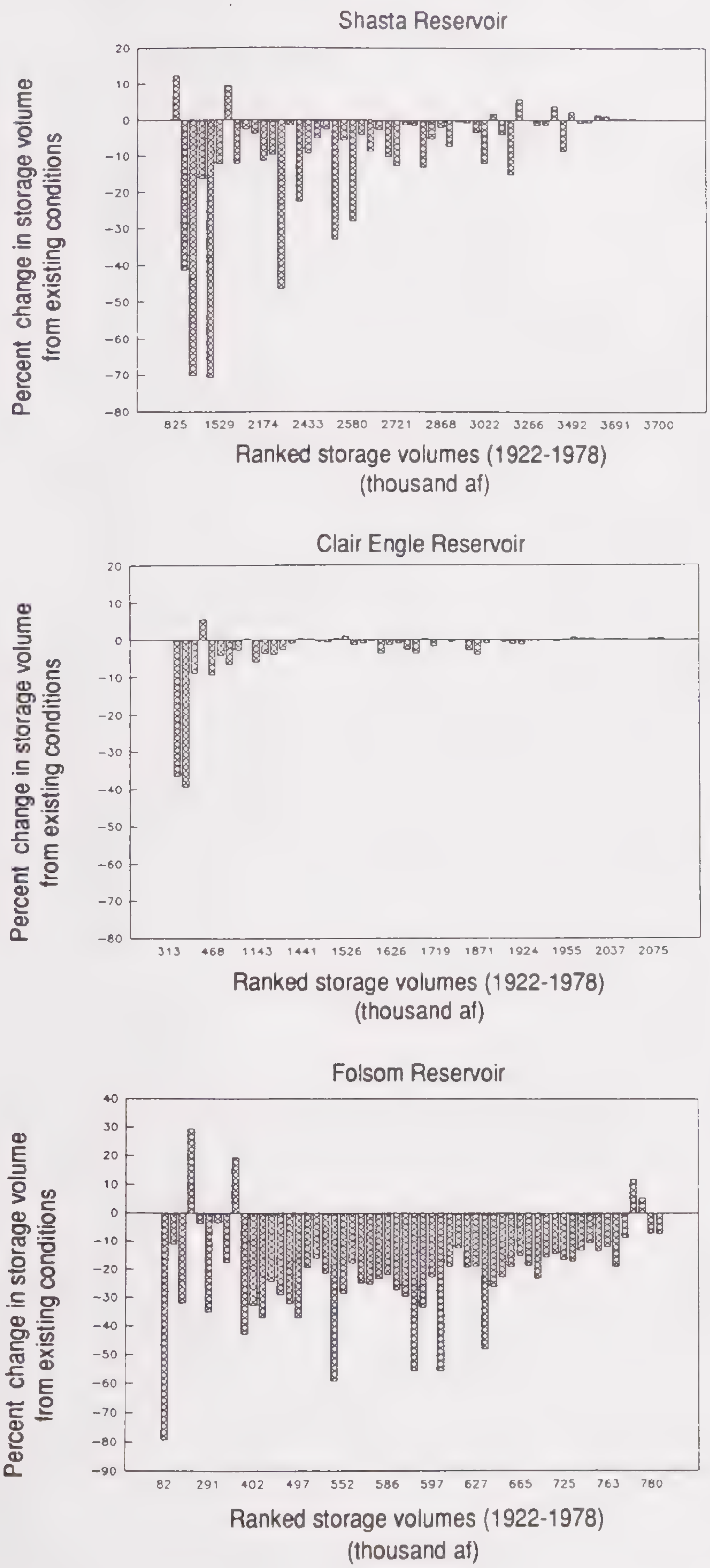


Figure 3-11. Change in September Storage Volumes in CVP Reservoirs under the No-Action Alternative

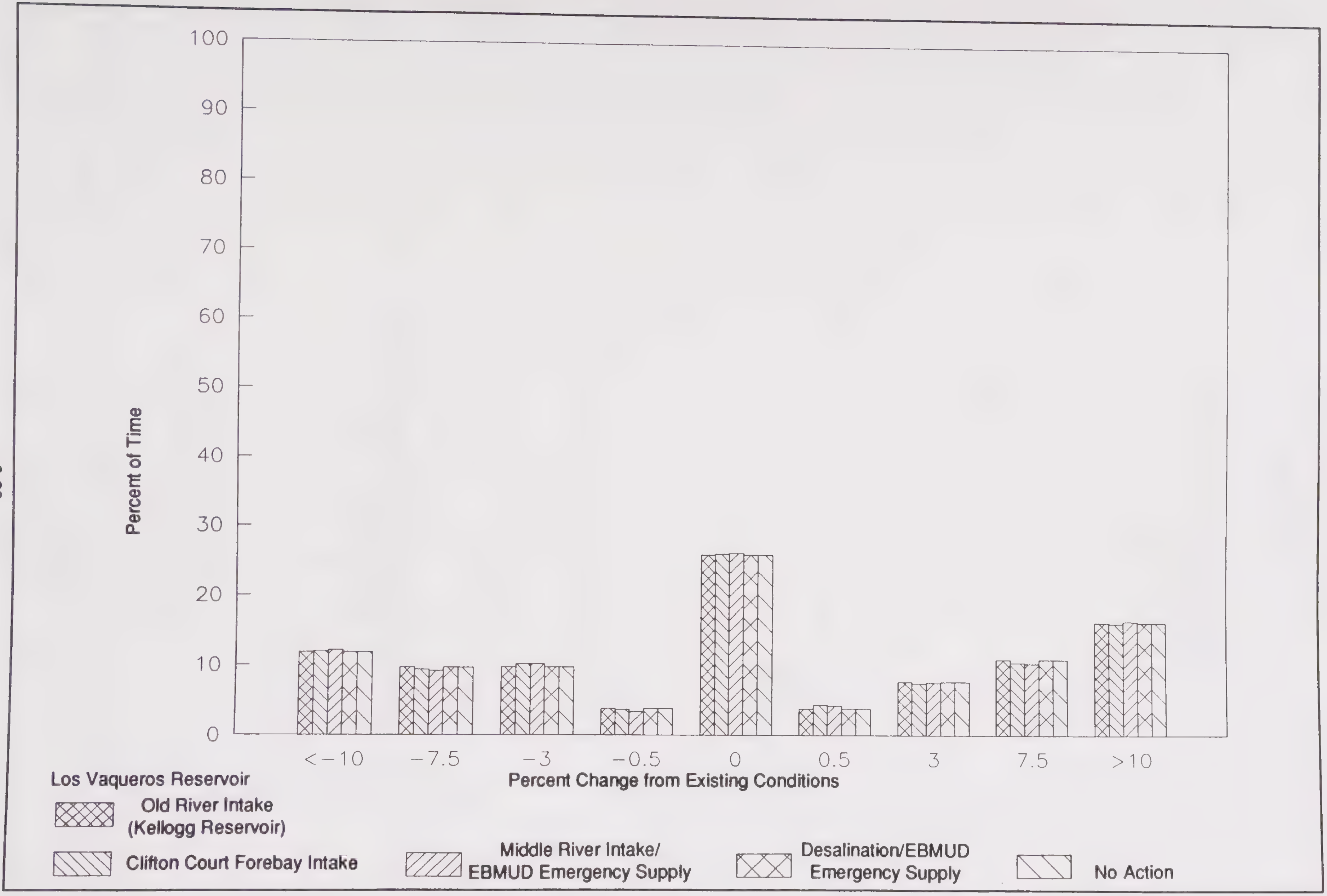


Figure 3-12. Frequency of Changes in Monthly Sacramento River Flows at Keswick Dam under the Alternatives under Future Conditions

be almost exactly the same as under existing conditions because the flow consists only of prescribed fish releases and rare spills.

Frequent decreases in some flows would occur in the American River at Nimbus Dam. Decreases of over 10% would occur almost 60% of the time (Figure 3-13). Flows would decrease over 80% of the time during May through December although increases would be more frequent than decreases in the remaining months.

Flooding. According to the modeling, maximum monthly flows under the No-Action Alternative would be equal to or smaller than those under existing conditions during the high-flow season (November through March) at all locations. In the Trinity River at Lewiston and the Sacramento River at Keswick Dam, flows would decrease in only 1 or 2 winter months and changes would not occur in other winter months. In the American River, modeling indicates that flows would decrease in every month of the high-flow season. The decreases would typically be 1-10% of flow. A separate analysis of the 20 largest monthly flows during the 57-year simulation period indicated that the majority of these flows, including at least the five greatest flows were less than flows under existing conditions. These decreases in high flows may result in small decreases in flood risk near Sacramento and in the Delta. This decrease would be beneficial.

Sediment Transport. The expected decreases in the largest monthly flows at most locations would tend to decrease erosion and sediment transport during large storms, which would decrease the need for dredging in ship channels in the Delta. In the western part of the Delta, however, erosion might increase because strong tidal currents would tend to compensate for the decrease in sediment influx by scouring levees. These effects are difficult to quantify and would be less than significant because most of the decreases in simulated large flows were by only a few percentage points.

The small decreases in high flows could slightly decrease erosion along the lower American River and decrease erosion in sediment deposition in the lower Sacramento River. Along the lower American River, a decrease in erosion could be beneficial because Folsom Reservoir intercepts sediment from upstream and tends to cause scour downstream of the dam. Little or no change in sediment transport would occur in the Trinity River or the Sacramento River at Keswick Dam. These changes would be less than significant.

Cumulative Future Conditions

The seasonal pattern of diversions from the Delta is substantially different under future cumulative conditions than under future conditions (Figure 3-5). Greater storage capacity south of the Delta enables SWP and CVP to increase diversions in winter and decrease diversions in summer. As a result, CCWD's diversions are a greater percentage of total diversions in summer, even through the amounts diverted are the same as under future conditions (Figures 3-6 and 3-7).

Delta. Statistical summaries of simulated monthly Delta flows are included in the Stage 2 EIR/EIS Technical Report (bound separately). Minimum monthly Delta inflow is lower than under existing conditions by up to 96,000 af/mo (14%) in every month except October. Minimum inflow is lower than under future conditions in most months, but higher in several months. The difference is less than 1% in April through June. Changes in median and average inflows follow the same seasonal pattern as changes in SWP and CVP export diversions. Based on the simulation, minimum Delta outflow would be the same as under existing and future conditions in almost all months because of D-1485 requirements. Median outflow would be substantially lower than under existing conditions, but the same or slightly lower than that under future conditions.

Decreases in minimum and median Delta inflow and outflow will not necessarily result in increased frequency and magnitude of reverse flows at Jersey Point or Twitchell Island. The North and South Delta Water Management Programs would enlarge selected channels in the Delta with the objective of decreasing

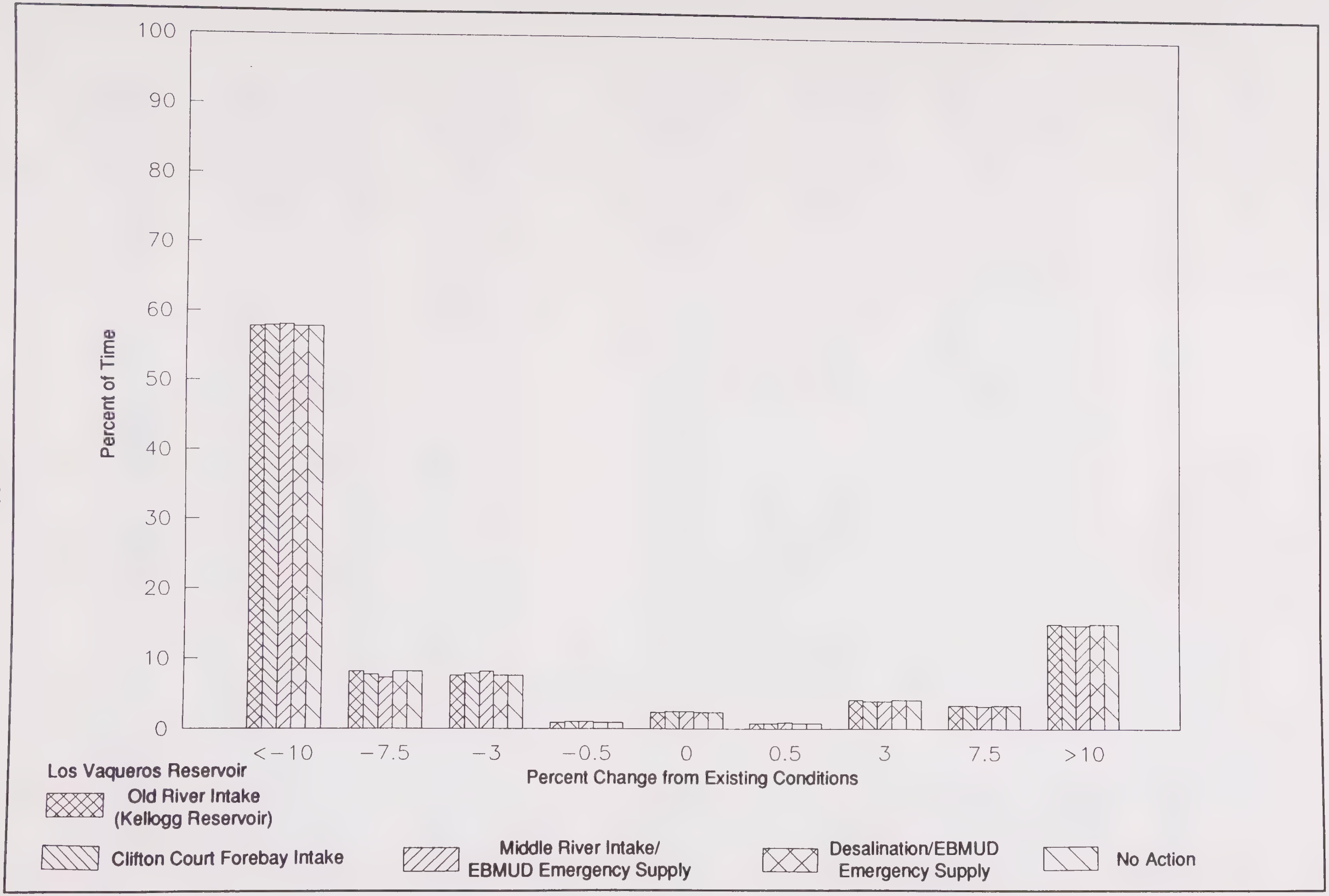


Figure 3-13. Frequency of Changes in Monthly American River Flows at Nimbus Dam under the Alternatives under Future Conditions

the occurrence of reverse flows. If these programs function as planned, fewer reverse flows would probably occur even with an 11% increase in annual exports and slight decreases in minimum Delta inflow and outflow in some months.

CVP Reservoirs and Waterways. In all three CVP reservoirs, minimum monthly storage levels would be substantially lower than that under existing conditions and slightly lower than that under the No-Action Alternative. For example, the lowest simulated storage level in Shasta Reservoir is 720,000 af under existing conditions, 373,000 af under future conditions, and 331,000 af under cumulative future conditions.

According to the simulation, minimum monthly flows in the American, Trinity, and Sacramento Rivers would be smaller than under existing and future conditions in some months and larger in others. In general, differences would be slight and minimum flows under cumulative future conditions would be more similar to flows under the No-Action Alternative than flows under existing conditions.

Flooding and Sediment Transport. Although simulated maximum monthly Delta inflow under cumulative future conditions differed in some months from maximum flows under the No-Action Alternative, the differences did not affect the peak-flow months and would not cause significant changes in flooding and sediment transport. At river locations upstream of the Delta, maximum monthly flows were within 1% of flows under the No-Action Alternative.

Los Vaqueros Reservoir Alternative

Delta and CVP Facilities

Effects of the Los Vaqueros Reservoir Alternative on flow in the Delta depend on the location of the intake structure for diversions to fill the reservoir. Two locations were simulated separately using the DWRSIM model: Old River at SR 4 and Clifton Court Forebay. Statistical summaries of flows and storage volumes at each location are included in the Stage 2 EIR/EIS Technical Report (bound separately).

Rock Slough/Old River Intake Configurations - Existing Conditions

Flow Regime. Under existing conditions, this configuration would generally allow CCWD to divert more water in winter and spring when surplus (unappropriated) water is available in the Delta and less in summer. As a result, minimum and average simulated storage levels in all three CVP reservoirs were larger in all months (except for a few months of no change in Clair Engle Reservoir). The simulated lowest minimum storage levels in Shasta and Folsom Reservoirs for the 57-year simulation period were greater by 43,000 af and 5,000 af, respectively. The only decreases in storage in September were in Folsom Reservoir at intermediate storage levels (Figure 3-14).

Flow in the Trinity River would be unaffected by this configuration. In the American and Sacramento Rivers, minimum flows would be unaffected in most months. Median and average flows would change by less than 2%. Overall, flows would remain the same about 78% of the time and very few increases or decreases greater than 3% would occur (Figures 3-15 and 3-16).

The shift in diversion season is also reflected in changes in average monthly Delta inflow, which is slightly smaller in May through October and larger in December through February. During March through May, some of the CCWD diversions result in decreases in Delta outflow, but none of these decreases affect the minimum monthly flows. Overall, the frequency and magnitude of changes in Delta inflow and outflow would be similar to those for the upstream river locations (Figures 3-17 and 3-18). In the Delta Cross Channel, the simulation indicates that the largest decrease would be by 12,400 af/mo (6%) in September. Increases and decreases in flow in the Delta Cross Channel would be both more frequent than for Delta inflow and outflow, but most changes would be by less than 1% (Figure 3-19).

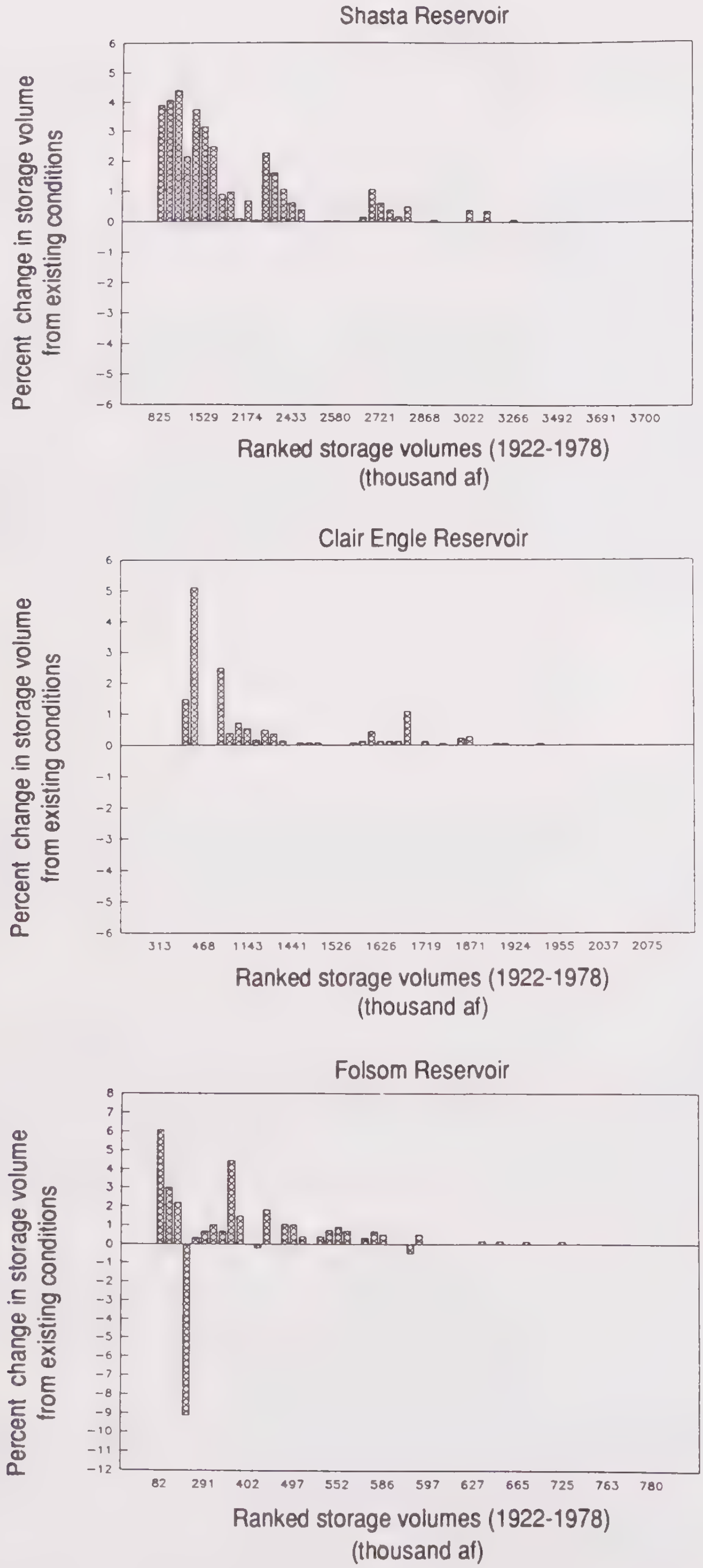


Figure 3-14. Change in September Storage Volumes in CVP Reservoirs under the Los Vaqueros Reservoir Alternative under Existing Conditions

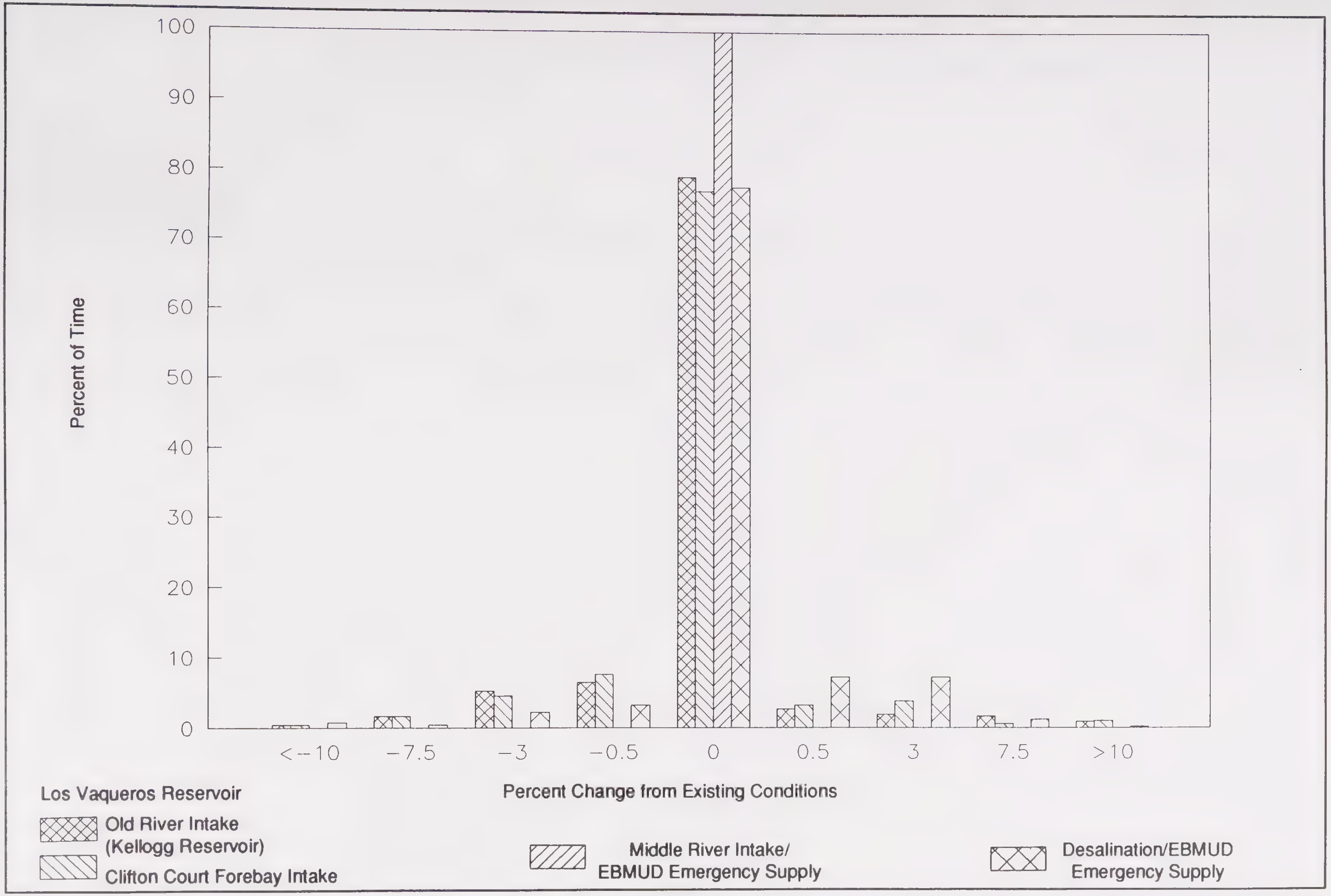


Figure 3-15. Frequency of Changes in Monthly American River Flows at Nimbus Dam under the Project Alternatives under Existing Conditions

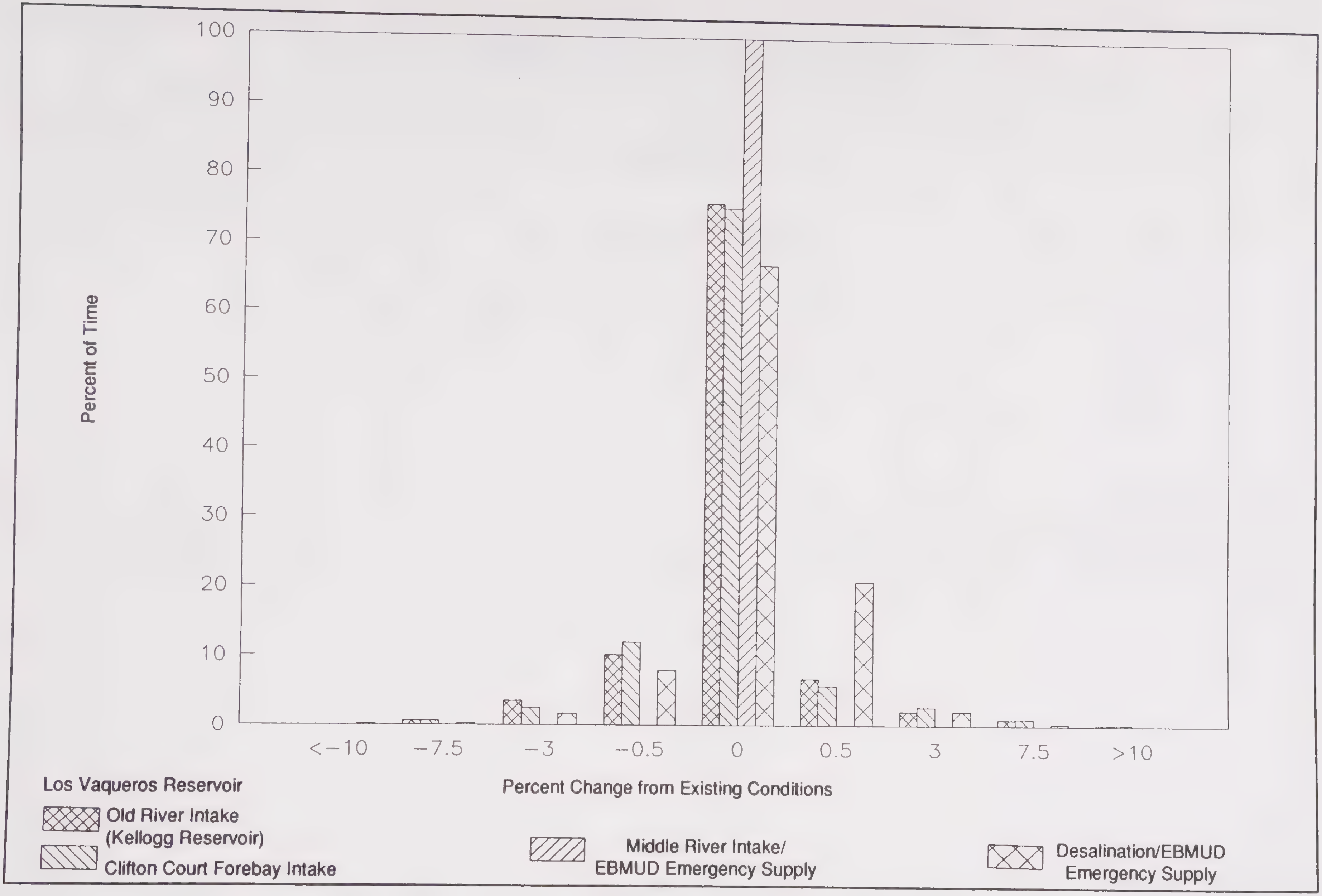


Figure 3-16. Frequency of Change in Monthly Sacramento River Flows at Keswick Dam under the Project Alternatives under Existing Conditions

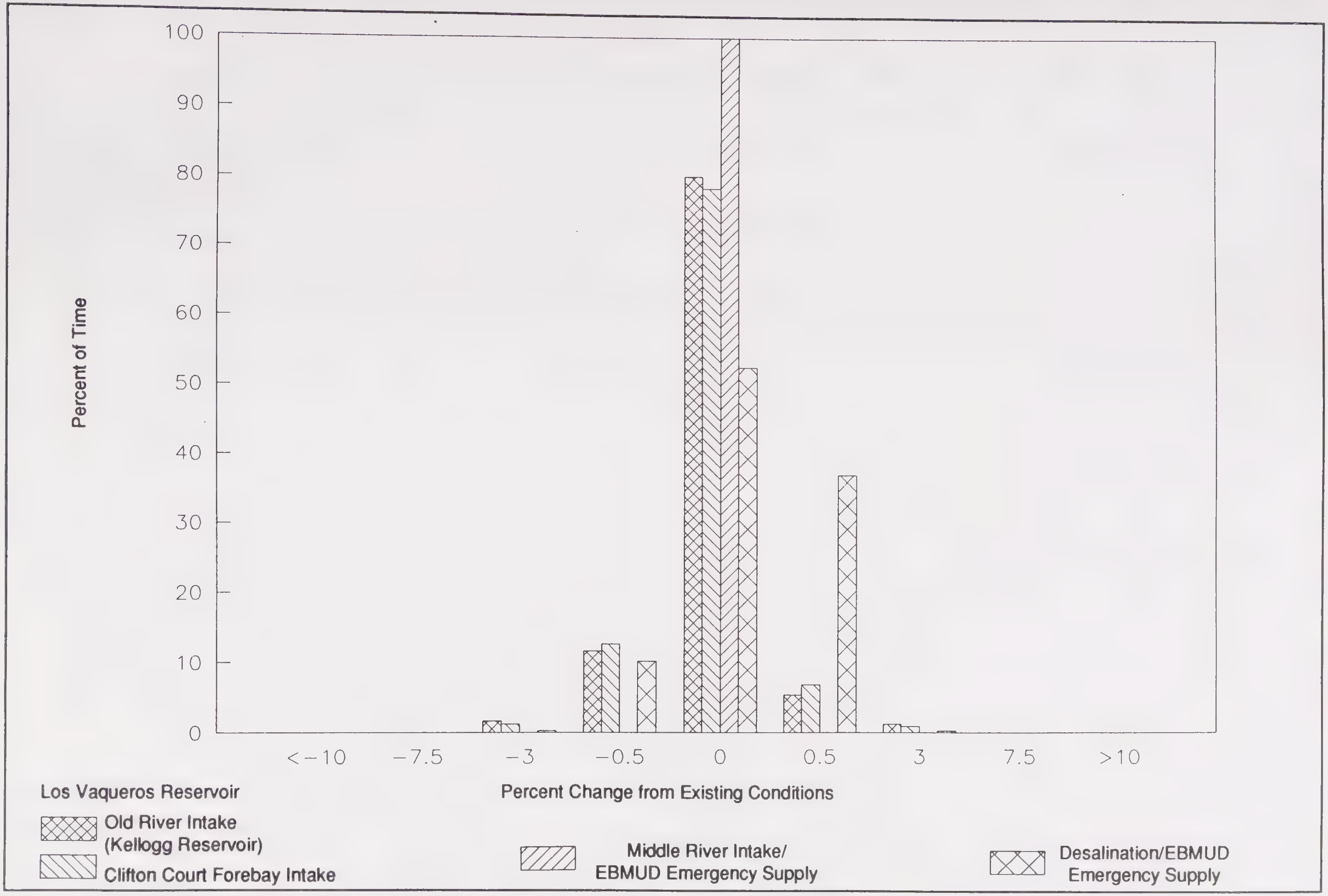


Figure 3-17. Frequency of Changes in Monthly Delta Inflow under the Project Alternatives under Existing Conditions

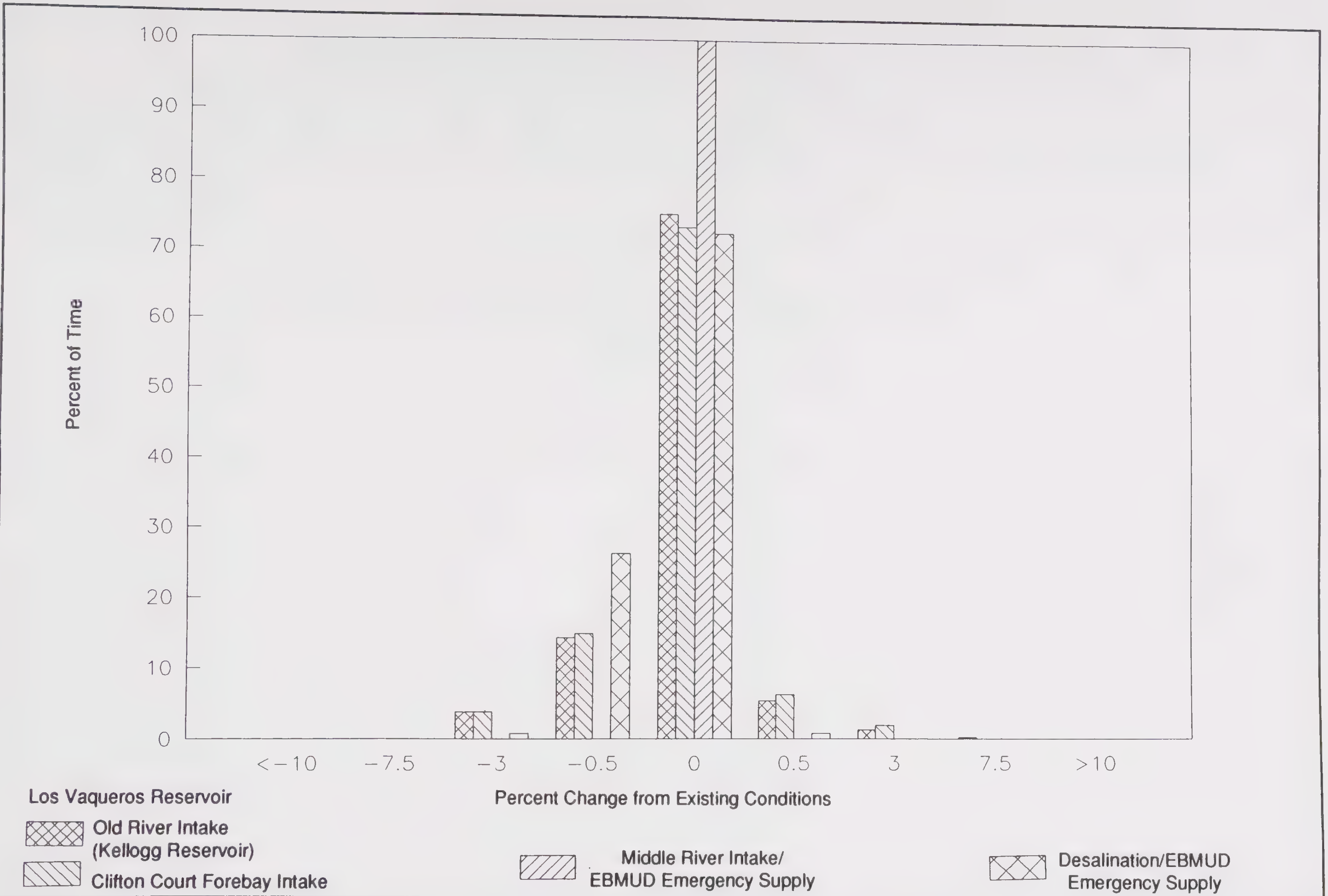


Figure 3-18. Frequency of Changes in Monthly Delta Outflow under the Project Alternatives under Existing Conditions

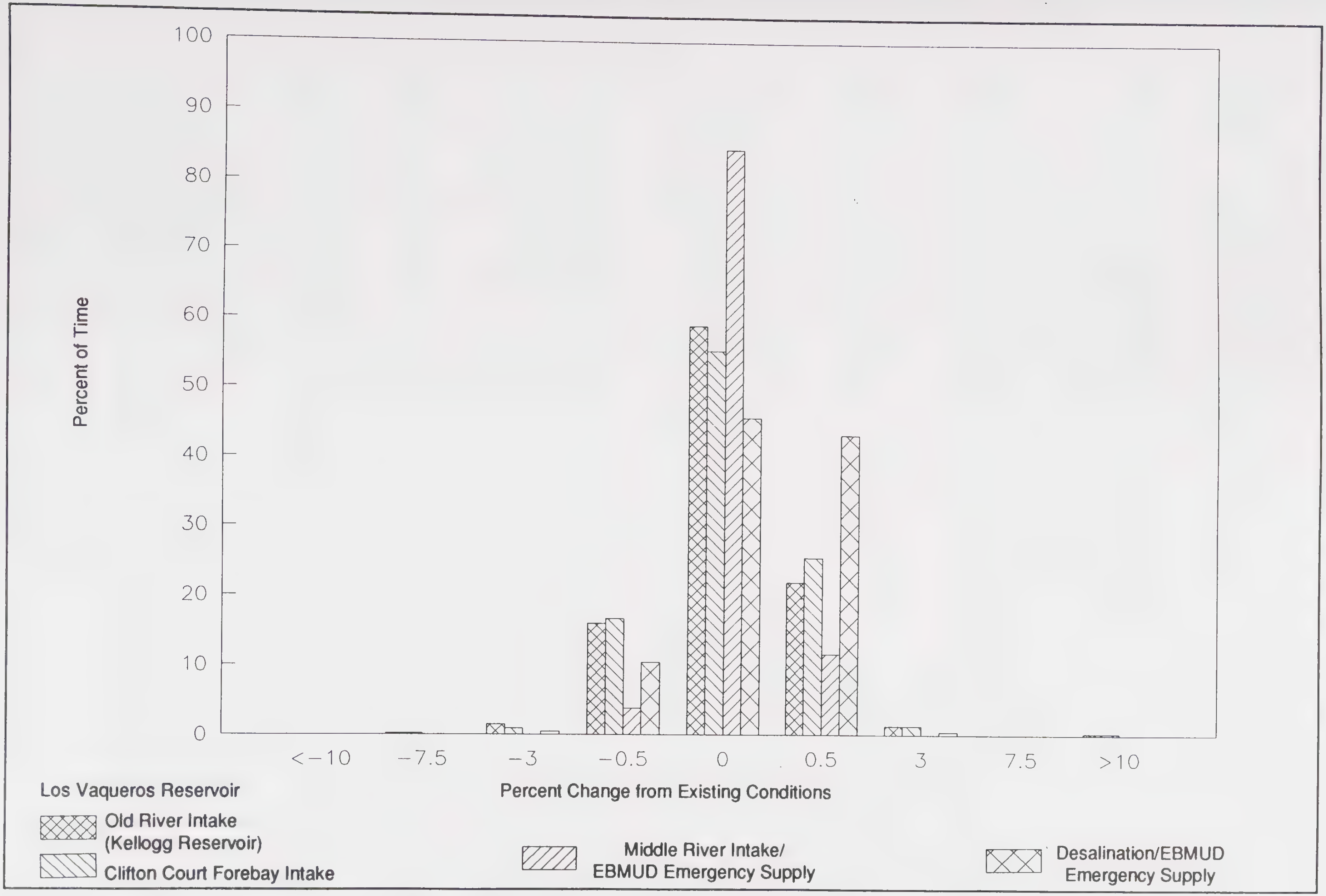


Figure 3-19. Frequency of Changes in Monthly Delta Cross Channel Flows under the Project Alternatives under Existing Conditions

Based on the simulation, the occurrence of reverse flows in the lower San Joaquin River would be almost identical to that for existing conditions (Figure 3-20). During 4 months, reverse flows would be relatively frequent by 1 or 2 years out of the 57-year simulation period.

Flooding and Sediment Transport. According to the modeling, few differences in maximum monthly flows between the Rock Slough/Old River configurations and existing conditions would occur. Increases and decreases would take place, but all flows would change by less than 1%. These small changes would have less-than-significant effects on flooding and sediment transport.

Rock Slough/Old River Intake Configurations - Future Conditions

Flow Regime. Changes in flow regime resulting from this alternative are nearly identical to the changes that would occur with the No-Action Alternative because the incremental changes in SWP and CVP operations resulting from this alternative are small. Thus, the flow regime for this alternative is generally the same as the changes discussed previously for the No-Action Alternative (compare the histograms in Figures 3-8 through 3-13).

When compared to the No-Action Alternative, the effect of this alternative under future conditions is essentially identical to its effect under existing conditions. Histograms showing the frequency and magnitude of flow changes for future conditions were similar to those shown for existing conditions in Figures 3-14 through 3-20.

Based on the simulation, even the largest differences in storage and flow regime between this alternative and the No-Action Alternative would be small. Minimum and average storage levels in all three reservoirs would decrease in all months by a smaller amount (relative to existing conditions) than under the No-Action Alternative. For example, the minimum storage in Shasta Reservoir for the entire simulation period would be 366,000 af compared to 349,000 af for the No-Action Alternative and 720,000 af for existing conditions. Minimum flow in November in the American River at Nimbus Dam would be 34,000 af compared to 30,000 af for the No-Action Alternative and 35,000 af for existing conditions.

In the Delta, the incremental changes in hydrology caused by the Los Vaqueros Reservoir Alternative would be less than 1% based on the simulation. The few exceptions did not follow a pattern. For example, median Delta outflow in January was 832,000 af compared to 844,000 af for the No-Action Alternative and 877,000 af for existing conditions. Minimum monthly flows at the Delta Cross Channel would differ from those for the No-Action Alternative by more than 1% in a few months, but the magnitudes of the changes would be less than 700, 300, and 200 af/mo at the three locations, respectively. The incremental differences in maximum flows would be by less than 1% in all months at all locations.

Flooding and Sediment Transport. Changes in flows under this alternative would not incrementally affect flooding and sediment transport. The effects previously discussed under the No-Action Alternative would also occur under this alternative.

Cumulative Future Conditions. Flow regimes, flooding, and sediment transport under cumulative future conditions would be essentially the same as under cumulative future conditions. Based on the simulation, differences between future and cumulative future conditions would be small, and incremental changes associated with this alternative would be even smaller.

Rock Slough/Clifton Court Forebay Configuration - Existing Conditions

Flow Regime. Under current demands, the Rock Slough/Clifton Court Forebay configuration would result in conditions nearly identical to those for the Rock Slough/Old River configuration (Figures 3-14 through 3-13). Based on the simulation, flow and storage changes for the two configurations at the locations evaluated would not differ by more than 1%, except on rare occasions at the reservoirs when storage levels were low.

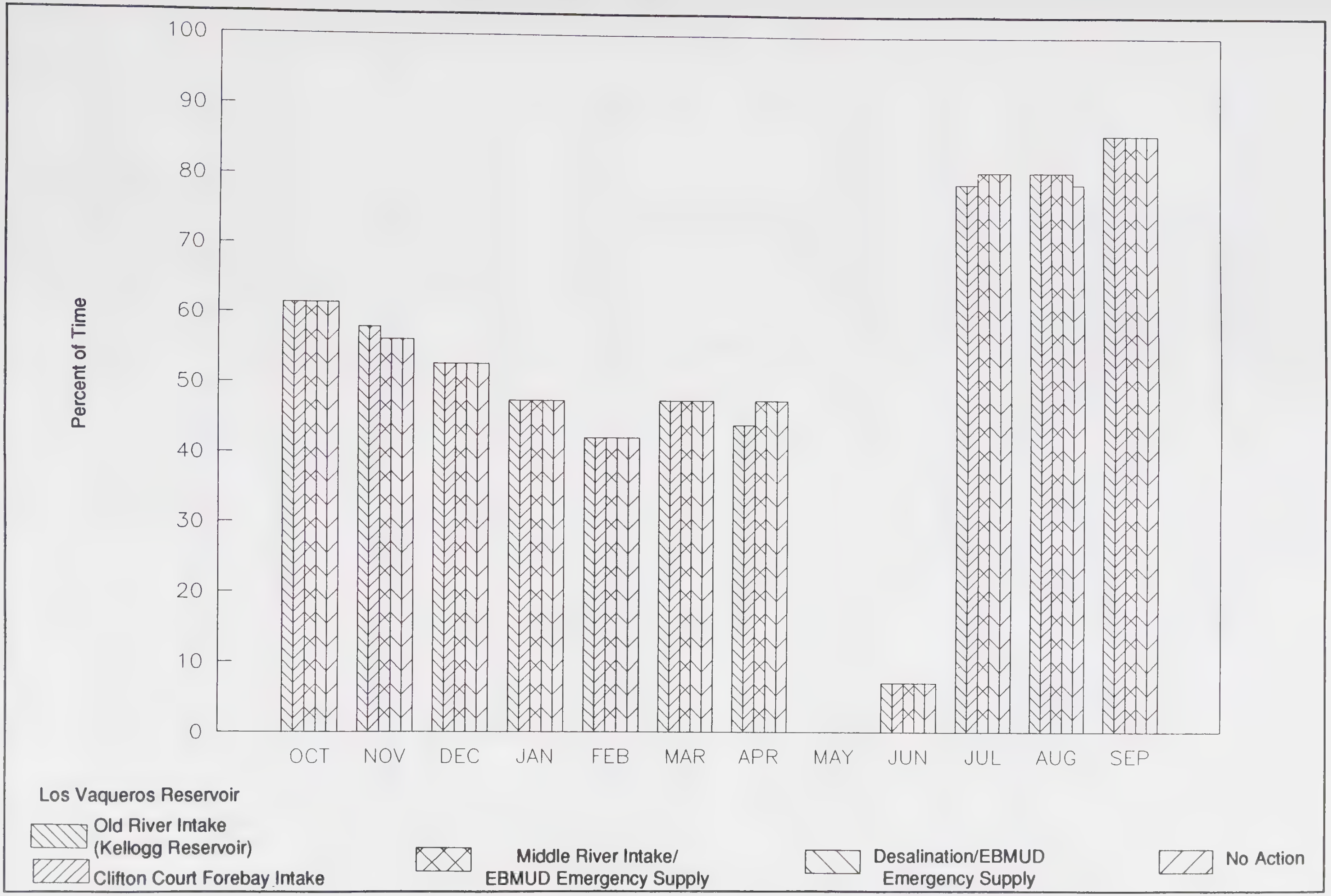


Figure 3-20. Frequency of Reverse Flows in the Lower San Joaquin River under the Alternatives under Future Conditions

Flooding and Sediment Transport. Based on the simulation, few differences in maximum monthly flows would occur between the Rock Slough/Clifton Court Forebay configuration and existing conditions, and all flows would change by less than 1%. These small changes would have less-than-significant effects on flooding and sediment transport.

Rock Slough/Clifton Court Forebay Configuration - Future Conditions

Flow Regime. Under future conditions, the flow regime upstream of the Delta for this configuration would be identical to the flow regime for the Rock Slough/Old River configuration described earlier according to the modeling. In the Delta, differences between this configuration, the Rock Slough/Old River configuration, and the No-Action Alternative would be less than 1%. Thus, differences between this alternative and existing conditions are essentially the same as those described earlier for the No-Action Alternative (Figures 3-8 through 3-13).

Flooding and Sediment Transport. Flooding and sediment transport in the CVP system streams and Delta channels would be the same as simulated under the Rock Slough/Old River configuration.

Cumulative Future Conditions. Flow regimes, flooding, and sediment transport under cumulative future conditions would be essentially the same as those under the No-Action Alternative. Based on the simulation, differences between future and cumulative future conditions would be slight, and incremental changes associated with this alternative would be even smaller.

Kellogg Reservoir Alternative

Delta and CVP Facilities

The effects of the Kellogg Reservoir Alternative on the flow regime, storage, flooding, and sediment transport in the Delta and CVP facilities would be identical to the effects described above for the Rock Slough/Old River configuration of the Los Vaqueros Reservoir Alternative because the timing and magnitude of project diversions would be the same.

Desalination/EBMUD Emergency Supply Alternative

Delta and CVP Facilities

Statistical summaries of flows and storage volumes under this alternative at each location are included in the Stage 2 EIR/EIS Technical Report (bound separately).

Existing Conditions

Flow Regime. The Desalination/EBMUD Emergency Supply Alternative would cause more frequent changes in flow and storage than would the other alternatives, and in some cases the changes would be substantially smaller or larger. Based on the simulation, this alternative would decrease storage only in Clair Engle Reservoir (Figure 3-21), whereas the other alternatives would increase flows or cause no change. Decreases in storage in Folsom Reservoir also would be much more frequent.

In the modeling, minimum storage was drawn down to smaller levels in all months in Shasta Reservoir and in several months in Clair Engle Reservoir. The minimum storage level in Shasta Reservoir would be smaller by 27,000 af (0.6% of capacity) according to the simulation. In contrast, minimum storage

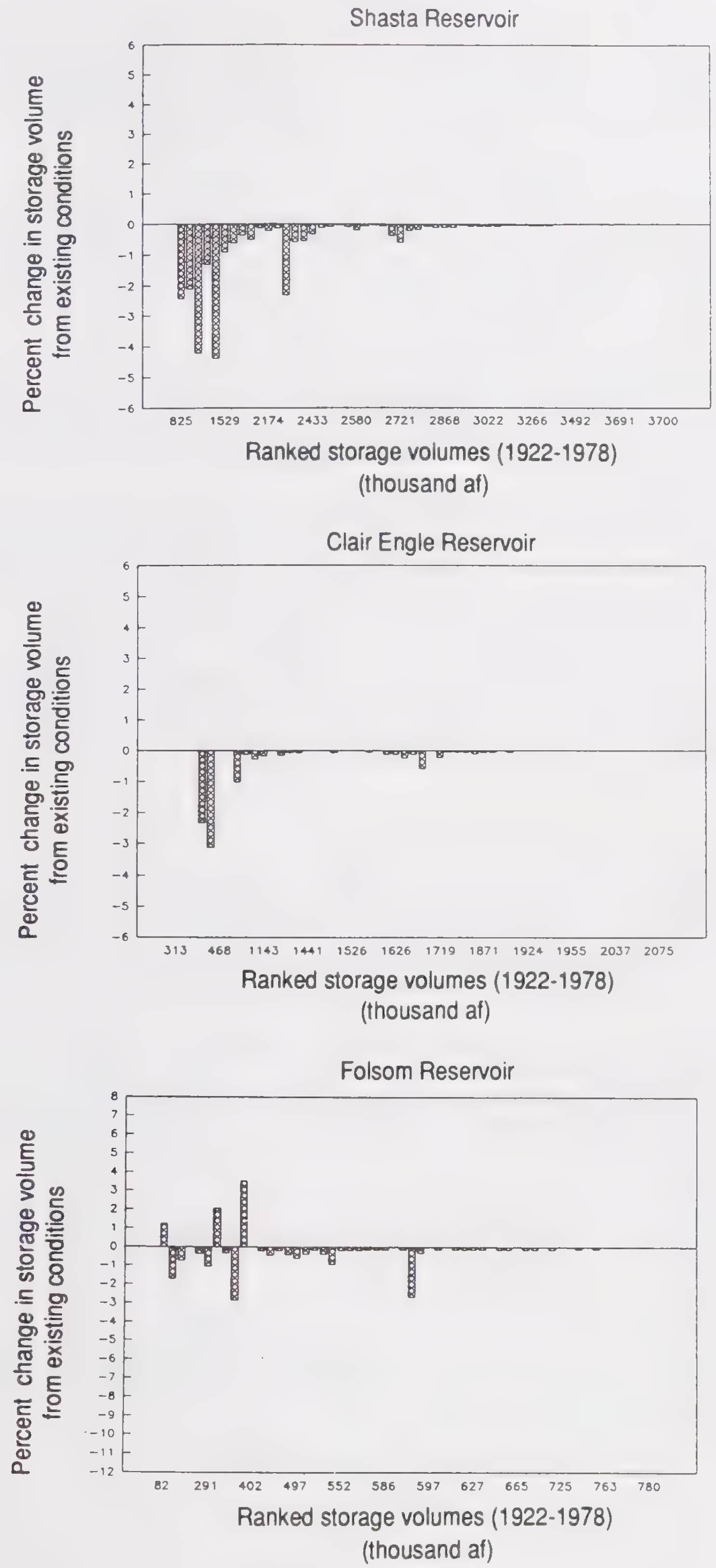


Figure 3-21. Change in September Storage Volumes in CVP Reservoirs under Desalination/EBMUD Emergency Supply Alternative under Existing Conditions

in Folsom Reservoir would be larger in all months, by up to 3,000 af (0.3% of capacity). This alternative would tend to deplete reservoir storage more than the other alternatives because it depends on existing CVP storage capacity for its supply of water. The other alternatives can draw partially or completely from unregulated flow.

Delta inflow would remain unchanged only 50% of the time, noticeably less than under the other alternatives (Figure 3-17). All changes would be small, however, and increases would be particularly frequent during June through October. Flow changes in the Delta Cross Channel would follow a similar pattern (Figure 3-19), but reverse flows in the lower San Joaquin River and Delta outflow would be more similar to flows under the other alternatives (Figure 3-18 and 3-20).

Compared to existing conditions, this alternative would result in increases in minimum Delta inflow in July through December and February through May by 1,000 to 7,000 af/mo (0.1% to 1.6%). Median, average, and maximum flows would be larger or smaller in many months, but would change by less than 1%. Minimum Delta outflow would be the same as that under existing No-Action Alternative conditions.

Based on the modeling, changes in the flow regimes in the Sacramento and American Rivers would be similar to the changes in Delta inflow, except changes would be slightly less frequent (Figures 3-15 and 3-16). A few increases in minimum flows would occur in the American River at Nimbus Dam and in the Sacramento River at Keswick Dam, including an increase of 7,000 af/mo (4%) in October at Keswick Dam. Median and average flows would increase and decrease at various rates of less than 2%.

Flooding and Sediment Transport. Although the Desalination/EBMUD Emergency Supply Alternative would result in a few changes in maximum simulated flows according to the simulation, these changes would be much less than 1%. These small changes would not cause significant changes in flooding or sediment transport.

Future Conditions

Flow Regime. Compared to existing conditions, hydrologic conditions under this alternative would be similar to those under the No-Action Alternative (Figure 3-8 through 3-13). At all locations except the reservoirs, the incremental effect of this alternative under future conditions is essentially the same as under existing conditions. Histograms of the frequency and magnitude of changes with respect to the No-Action Alternative are nearly identical to those for existing conditions (Figures 3-15 through 3-20).

Minimum monthly storage levels in all three CVP reservoirs would be much lower than under existing conditions and slightly lower than under the No-Action Alternative. This is evident in a comparison of changes in September storage under future conditions (Figure 3-22) with changes under existing conditions (Figure 3-21). For example, the minimum storage level in Shasta Reservoir was 334,000 af (7% of capacity) compared to 720,000 af for existing conditions and 349,000 af for No-Action Alternative.

Flooding and Sediment Transport. The changes in maximum monthly flows for the alternative would be similar to those under the No-Action Alternative. Therefore, this alternative would have few or no incremental effects on flooding and sediment transport.

Cumulative Future Conditions. Flow regimes, flooding, and sediment transport under cumulative future conditions would be essentially the same as that described under cumulative future conditions. Differences between future and cumulative future conditions would be slight, and incremental changes associated with this alternative would be even smaller.

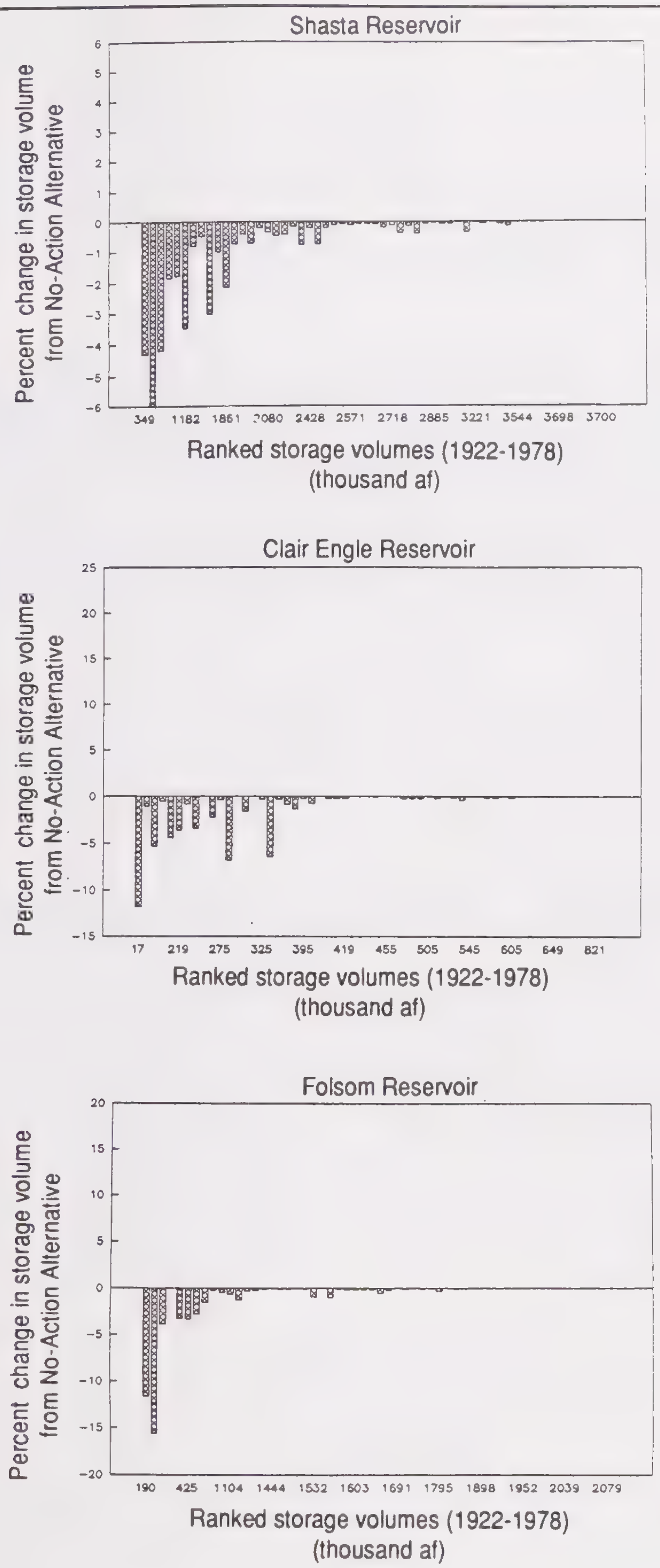


Figure 3-22. Change in September Storage Volumes in CVP Reservoirs under Desalination/EBMUD Emergency Supply Alternative under Future Conditions

Middle River Intake/EBMUD Emergency Supply Alternative

Delta and CVP Facilities

Statistical summaries of flows and storage volumes under this alternative at each location are included in the Stage 2 EIR/EIS Technical Report (bound separately).

Existing Conditions

Flow Regime. According to the simulation, few differences in flow regime would occur between this alternative and existing conditions because the timing and magnitude of diversions are identical. Simulated Delta inflow, riverflow, and storage in all upstream CVP reservoirs would be the same as that under existing conditions. Delta outflow also would be unchanged.

This alternative would slightly affect flow patterns in the Delta. Shifting CCWD's point of diversion from Old River to Middle River would require increases in flow through the Delta Cross Channel in some years. Overall, however, flows in the Delta Cross Channel would remain unchanged about 85% of the time (Figure 3-19). The occurrence of reverse flows in the lower San Joaquin River would change only slightly (Figure 3-20).

Flooding and Sediment Transport. Few differences in maximum monthly flows between the Middle River Intake/EBMUD Emergency Supply Alternative and existing conditions would occur. All flows would differ by less than 1% and would have less-than-significant effects on flooding and sediment transport.

Future Conditions

Flow Regime. Based on the modeling, the flow and storage regimes upstream of the Delta for this alternative would be identical to those under the No-Action Alternative. Simulated flow regimes in the Delta would be nearly identical (Figures 3-9, 3-10, and 3-20). The incremental effects of this alternative under future conditions is almost identical to its effects under existing conditions.

Flooding and Sediment Transport. Flooding and sediment transport under this alternative would be identical to flooding and sediment transport under the No-Action Alternative because no differences in maximum flows would occur.

Cumulative Future Conditions. Flow regimes, flooding, and sediment transport under cumulative future conditions would be essentially the same as that under cumulative future conditions. Differences between future and cumulative future conditions would be slight, and incremental changes associated with this alternative would be even smaller.

MITIGATION MEASURES

All Alternatives

No mitigation is required.

Chapter 4. Delta System Fisheries Resources

AFFECTED ENVIRONMENT

The purpose of this section is to identify fish species potentially affected by implementation of the alternatives considered in this EIR/EIS, describe species population responses to existing and variable environmental conditions, and provide estimates of species population abundance and distribution. The alternatives could affect fish and habitat in the Trinity, Sacramento, and American Rivers; the Delta; and the Bay (Figure 4-1). More than 100 fish species occur in the rivers, Delta, and Bay. Population and life history information is unavailable for most species. Detailed review of species that support major commercial and sport fisheries and species that have been identified as species of special concern, including federally listed and state-listed threatened and endangered species is provided in the Stage 2 EIR/EIS Technical Report (bound separately).

Chinook Salmon

Four runs of chinook salmon (fall, late fall, winter, and spring) occur in the Sacramento River and the fall run occurs in the San Joaquin River. The fall-run chinook is the most abundant race, comprising about 80% of the Sacramento basin stock (Kjelson et al. 1982). Over 90% of the Central Valley salmon population spawns in the Sacramento River system and about 10% spawns in the San Joaquin River system. The Trinity River supports fall and spring runs of chinook salmon. The American River currently supports only a fall run but historically supported a spring run.

River-spawned chinook salmon populations have declined in abundance from historical levels. Fall-run populations have been augmented by hatchery production, and escapement (i.e., adults returning to spawn in fresh water) has stabilized. Depending on the destination of the fall run, escapement of river-spawned fish is 10-50% of pre-1960 levels (U.S. Fish and Wildlife Service 1987). In contrast, late-fall- and winter-run populations are comprised primarily of river-spawned fish, and historical escapement continues to decline. Spring-run escapement has fluctuated dramatically and spring-run chinook salmon that spawn in the Sacramento River may no longer be distinct from the fall-run stock (Reynolds et al. 1990).

Delta

The Delta and Bay serve as a migration path for adult chinook salmon returning to their natal rivers to spawn. Different runs of adult chinook salmon move through the Delta every month (California Department of Water Resources and California Department of Fish and Game 1982). Timing of adult migration is an inherent characteristic of each run, modified by response to river temperature and flow.

Migrating juvenile chinook salmon, both smolt and fry, are found in the Delta and Bay throughout the year and migrate through the Delta primarily from October through June (Figure 4-2). Smolt are juveniles that have undergone physiological changes that enable them to survive in salt water. Smolt generally migrate through the Delta in less than 1 week. Fry are juveniles that have not yet become smolt and may rear in the Delta for more than 1 month before maturing into smolt.

Environmental conditions in the Delta affect survival of adult and juvenile chinook salmon. Conditions affected by SWP and CVP operations include inflow volume, diversion via the Delta Cross

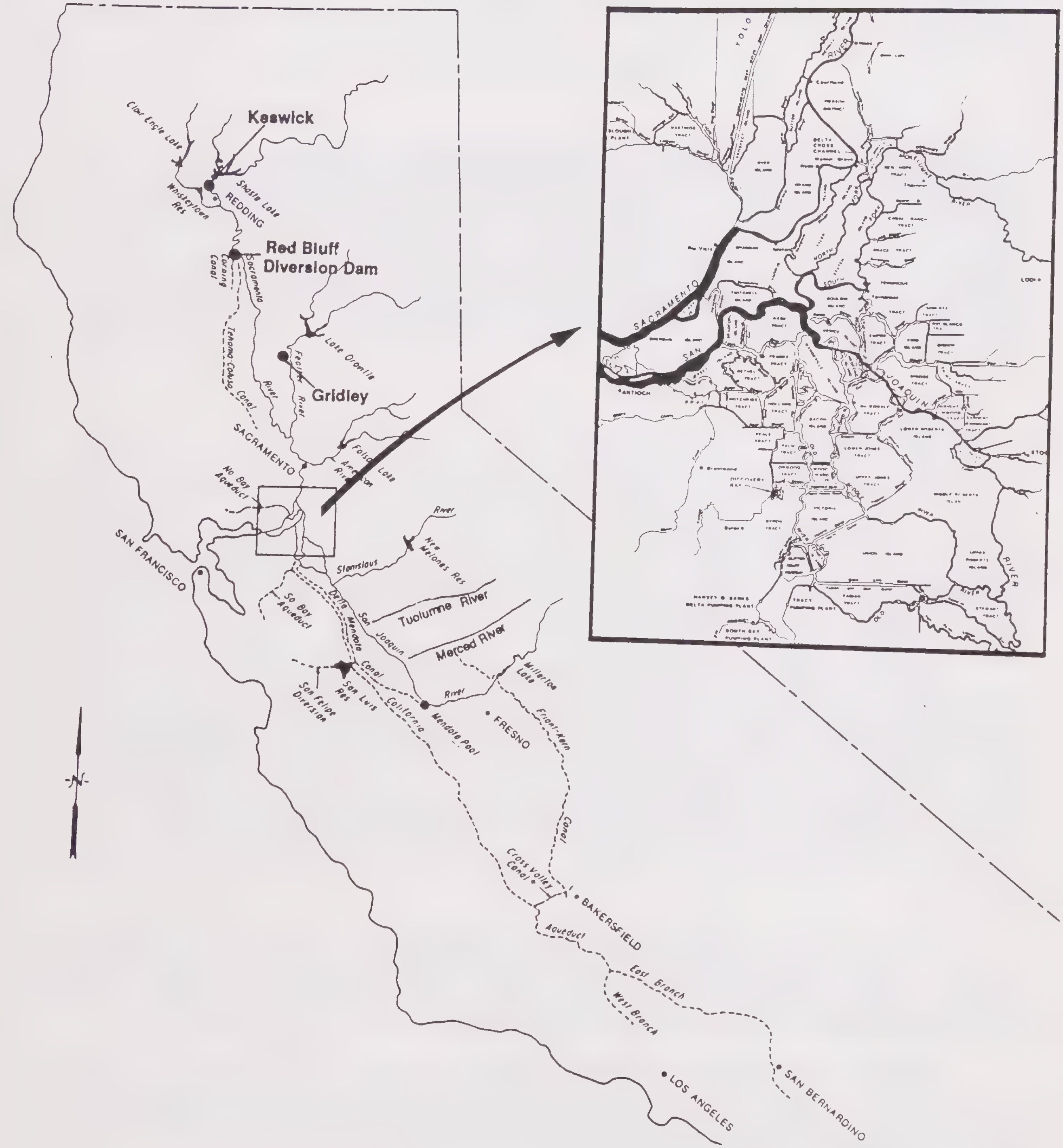


Figure 4-1. Delta Area Waterways and Primary CVP and SWP Facilities

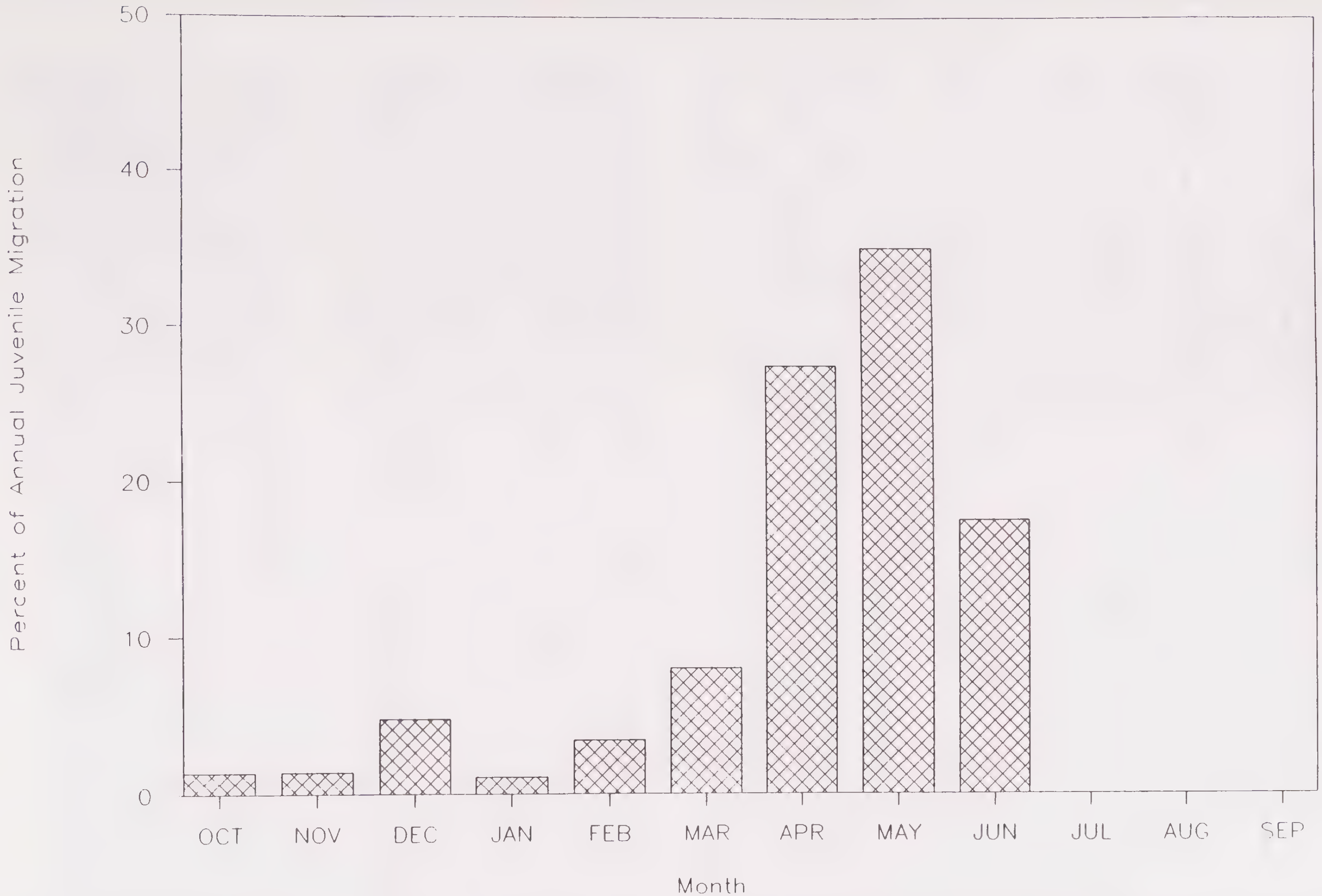


Figure 4-2. Timing of Juvenile Chinook Salmon Migration through the Sacramento–San Joaquin Delta

Source: State Water Project and Federal Water Project fish salvage data, 1981–1988

Channel, lower San Joaquin River net flow, and volume diverted from the Delta. Specific environmental conditions that potentially affect the survival and growth of juvenile chinook salmon include temperature, predation, food production (and availability), and pollutant concentration (Herrgesell et al. 1983, California Department of Fish and Game 1987g).

Studies by the U.S. Fish and Wildlife Service (USFWS) (1987) showed that survival of hatchery-reared fall-run smolt released in the Sacramento River upstream of the Delta Cross Channel is lower than the survival of the hatchery-reared fall-run smolt released in the Sacramento River downstream of the Delta Cross Channel when the channel gates are open. A proportion of the fish released upstream of the Delta Cross Channel are drawn into the central Delta. Movement through the central Delta exposes smolt to increased predation, higher temperatures, and more agricultural diversions. Complex channel configurations and the absence of seaward flow in the central Delta confuse the smolt and delay or prevent passage to the ocean. Chinook salmon smolt that avoid diversion out of the Sacramento River at the Delta Cross Channel and Georgiana Slough probably migrate to the ocean without delay.

For smolt drawn into the central Delta via the Delta Cross Channel and Georgiana Slough, delay and exposure to predation probably increase when flow in the lower San Joaquin River is reversed and export by the CVP and SWP is high.

Hatchery-reared fall-run smolt released at several Delta locations experienced the lowest survival rates when released in Old River south of its junction with the San Joaquin River (U.S. Fish and Wildlife Service 1987, California Department of Fish and Game 1987g). The lower survival rate probably resulted from migration toward the SWP and CVP pumps rather than seaward. Mortality is higher because of elevated temperatures in the south Delta during late spring, increased predation in Clifton Court Forebay and at the SWP and CVP fish protection facilities, and entrainment in export.

Rivers

Change in Delta conditions has contributed to the decline in chinook salmon populations. Change in upstream conditions, however, is the primary factor responsible for decline in abundance of river-spawned fish relative to historical levels. Dams have blocked access to historical spawning and rearing areas and restricted spawning and rearing to habitat where environmental conditions are dependent on reservoir operations. The distribution and abundance of each run is limited by the availability of suitable habitat during chinook spawning seasons.

Temperature. Chinook salmon are coldwater species sensitive to temperature changes within and above optimum levels. In general, all chinook salmon species at all life stages prefer temperatures between 42°F and 58°F (Reiser and Bjornn 1979). Temperatures of up to 68°F are tolerable for migrating juveniles and adults (California State Water Resources Control Board 1990), although juvenile survival during migration through the Delta appears to decline at temperatures above 60°F (Kjelson et al. 1989).

In the Sacramento River, fall-run spawning activity typically peaks in November but varies annually depending on water temperatures; higher water temperatures (greater than 60°F) are known to delay fall spawning. Late-fall-run chinook spawn from January through March, winter-run fish typically spawn from April to early August, and spring-run fish spawn from late August to early October.

Temperatures in the Sacramento River below Keswick Dam frequently exceed levels that adversely affect survival of eggs and juvenile salmon. Survival of winter-, spring-, and fall-run chinook salmon in the river have been reduced by elevated temperatures. Elevated river temperatures may result when Shasta Reservoir storage is low and reservoir temperatures are high. Low reservoir storage occurs primarily during drought conditions; however, increasing water demands on the CVP may increase the frequency and

intensity of elevated river temperatures in the Keswick to Red Bluff Diversion Dam river section (Reynolds et al. 1990).

Chinook salmon enter the American River between August and January (Gerstung 1971, Leidy and Li 1987). Spawning usually begins in October and ends by January (Gerstung 1971). Lower American River water temperatures often exceed levels optimal for egg survival (i.e., 57.5°F) through November, affecting both in-river and hatchery production. Spring rearing temperatures can become detrimental during May and June (Leidy and Li 1987).

Flows. Flows affect spawning, rearing, and migration habitat availability. Fluctuating flow can dewater nests, killing eggs and alevins and stranding juveniles.

Based on available information, 6,000 cfs is believed to provide good to optimal spawning and rearing habitat area in the upper Sacramento River (U.S. Fish and Wildlife Service 1987). A major study is nearing completion that will provide detailed information on chinook salmon habitat needs and availability in relation to flow rates (Hayes pers. comm.).

Instream flow studies on the American River indicate that maximum spawning habitat is present at about 1,750 cfs and maximum rearing habitat is present at 300-1,000 cfs.

Winter-Run Chinook Salmon

Additional information is provided for the winter-run chinook salmon because it is listed as a threatened species under the federal Endangered Species Act and as an endangered species under the state Endangered Species Act.

The estimated number of winter-run salmon has declined from a 3-year average (1967-1969) of 83,916 fish to less than 2,000 fish during the 1980s. In 1990 and 1991, the winter run was estimated to be less than 450 and 200 fish respectively (Smith pers. comm.). The continued decline may be attributable to drought conditions since 1987.

Although riverine factors are the main cause of winter-run decline, estuarine factors (i.e., diversion into the Delta Cross Channel or entrainment in Delta diversions) also affect survival rates. Juvenile winter-run chinook appear to be most numerous in the Delta during February-April (Figure 4-2).

The Red Bluff Diversion Dam is believed to be one of the causes of reduced winter-run chinook salmon abundance (U.S. Fish and Wildlife Service 1988, Fisher pers. comm.). Another cause of reduced winter-run abundance is deleterious temperatures in the Sacramento River above the Red Bluff Diversion Dam during the spawning, incubation, and early rearing period.

Striped Bass

Striped bass spend most of their lives in the ocean or estuary but migrate into fresh water to spawn. California's striped bass production is dependent on conditions in the Bay, Delta, and Sacramento River.

The adult striped bass population declined from 3 million fish in the 1960s to about 1 million in the 1980s and about 500,000 fish in 1990 (California Department of Fish and Game 1987c, Stevens pers. comm.). Factors that contribute to reduced survival include direct and indirect effects of water diversions, reduced food availability and egg production, water pollution, predation, fishing (including poaching), and competition with native and introduced species.

Adult striped bass are found in the Delta and Bay throughout the year. About 45% of the stock spawns in the Delta during April and May; the remainder spawn in the Sacramento River during May and June.

Striped bass broadcast-spawn their semibuoyant eggs in open fresh water, where the eggs drift with the current and hatch in about 2 days (California Department of Fish and Game 1987c). Newly hatched larvae also drift with the current, are carried into Suisun Bay or farther downstream during high Delta outflow.

Year class survival appears to be greatest when currents carry young bass out of the Delta and into Suisun Bay. For striped bass spawned in the lower San Joaquin River, survival is greatest when the net flow in the lower San Joaquin River is seaward. Net flow direction and volume in the lower San Joaquin River is dependent on riverflow and diversions from the Delta. Flow through the Delta Cross Channel and Georgiana Slough adds to the flow in the lower San Joaquin River. As long as inflow to the lower San Joaquin River exceeds diversions, net flows will be seaward.

Survival of eggs and larvae moving down the Sacramento River, however, is likely lower for the proportion of the population drawn into the Delta Cross Channel and Georgiana Slough with diverted Sacramento River water than for the proportion that continue down the Sacramento River.

Striped bass are most vulnerable to diversion-related mortality from April to mid-July, during egg, larval, and early juvenile life stages (California Department of Fish and Game 1987c). Annual egg, larva, and juvenile mortality caused by entrainment is significant and may affect future adult abundance (Turner 1987). Mortality from entrainment alone, however, does not explain the decline in striped bass population (Brown 1987a).

Delta Smelt

Delta smelt are native to the estuary. Since 1981, the population has been generally lower than in the 1970s. The Delta smelt's low abundance has recently prompted USFWS to propose it for federal listing as a threatened species.

Smelt range from the Delta into Suisun Bay, where they generally school in open surface waters (Moyle 1976). Smelt migrate into the upper channels of Suisun Bay and the lower reaches of the Delta in fall. Smelt spawn in dead-end sloughs and channels during February through June where the adhesive eggs are deposited over submerged tree branches or sandy and rocky substrate (Radtke 1966, Wang 1986, and Stevens et al. 1990).

Factors of primary concern that affect smelt abundance include loss of habitat (caused by changes in flow patterns and salinity distributions), entrainment in local diversions and export, decreased spawning population abundance, invasions of exotic phytoplankton and invertebrates, and decreased food availability (Stevens et al. 1990).

Assuming that salvage is indicative of vulnerability to entrainment, Delta smelt are most vulnerable during May, June, and July. March and April are also likely periods of high vulnerability to entrainment.

American Shad

Adult American shad migrate into fresh water from the ocean and the Bay during March, April, and May (California Department of Fish and Game 1987d). Spawning begins in May and continues into early July (California Department of Fish and Game 1987d).

The primary spawning grounds are in the upper Sacramento, Feather, Yuba, and American Rivers, although shad may spawn in the northern Delta and the northern portion of Old River (California Department of Fish and Game 1987d). The semibuoyant eggs sink slowly and drift with the flow. The eggs hatch in 4-6 days.

Shad spawned in the Sacramento River system generally rear in the tributary rivers and mainstem downstream from the spawning area. Shad spawned in the Delta appear to rear primarily in the Delta. The locations of major rearing areas vary from year to year and seem to be dependent on riverflow (i.e., high flows transport the eggs and larvae farther downstream) (California Department of Fish and Game 1987d).

Most juvenile American shad emigrate from their freshwater rearing areas and enter the Bay between September and December (Stevens 1966).

The highest juvenile abundance, which varies more than an order of magnitude from year to year, occurs in years with high riverflows during the spawning and rearing periods (Stevens et al. 1983). The cause of increased juvenile abundance following high spring flows is unknown.

American shad is the third most common fish entrained at the SWP and CVP pumps (California Department of Fish and Game 1987). Newly metamorphosed juveniles are entrained during July and are probably the progeny of adults that spawned in the Delta. Entrainment during fall affects juveniles 50-150 cm long. The majority of these fish are probably the progeny of upstream-spawning adults that are diverted toward the pumps during their outmigration.

Bay Species

The Bay includes habitats in Suisun, San Pablo, and San Francisco Bays. Over 100 species of fish are found in the Bay, including marine, estuarine, and freshwater species.

Delta outflow can influence abundance and distribution of fish and invertebrates in the Bay, but the response of organisms to outflow is species and life-stage dependent. The variability in the response of organisms to different outflow levels may be an important factor in the dynamics of the estuarine community.

The effect of Delta outflow pulses on organisms in the Bay is determined by the timing and magnitude of the pulses. Outflow pulses during October-December are generally less than 50,000 cfs, while pulses during January to March may be much larger. Spring snowmelt contributes to moderate outflow pulses during April to June.

The cause-and-effect relationship between flows and organism abundance is complex, often dictated by a chain or web of events rather than by direct effects. Although some correlations between flows and organism abundance have been identified, the factors that cause the correlations are unknown.

Fish and invertebrate species actively or passively changed location when Delta outflow levels changed. Change in distribution, however, does not necessarily mean that abundance changes.

Three general parameters that are affected by Delta outflow and that may affect abundance and distribution of some Bay species are salinity, direct transport by currents, and nutrient levels. The effects of outflow on physical, chemical, and biological conditions are greatest in Suisun Bay, lesser in San Pablo Bay, and the least at the mouth of the Bay near the Golden Gate Bridge.

Reservoir Species

CVP and SWP reservoirs, including Clair Engle, Shasta, Folsom, Millerton, New Melones, and Oroville, provide an important component of freshwater angling in California. These reservoirs have greatly increased warmwater game fish production (primarily centrarchids); however, large, self-sustaining game fish populations are uncommon in reservoirs. Periodic stocking to meet sport fishing demands is usually required to maintain some game fish populations because reproductive success is limited by water level fluctuations and declining elevations during late spring (Leidy and Myers 1984).

Adverse effects on spawning sport fishes, such as largemouth bass, occur when water levels increase or decrease in shallow spawning areas during the spawning, incubation, or rearing periods. Nests may be dewatered or declining water levels may force adults to abandon nests, exposing eggs and juveniles to increased predation. Declining water levels often eliminate desirable shoreline habitat that provides structural cover for juvenile fishes (e.g., riparian and rooted aquatic vegetation and rocks).

Fisheries Monitoring, Enhancement, and Habitat Improvement Actions

Reclamation and DWR are participating in actions to increase survival rates, reproductive success, and abundance of fish in the Sacramento River and San Joaquin River systems and Delta. In addition, they are participating in studies to improve the quality and availability of information on the biology and ecology of fish populations in the Sacramento River and San Joaquin River systems, Delta, and Bay.

Activities being undertaken by Reclamation include:

- funding USFWS studies on the effects of flow releases from New Melones Reservoir on chinook salmon in the Stanislaus River;
- implementing USFWS and National Marine Fisheries Service (NMFS) recommendations for mitigating fish passage problems at Red Bluff Diversion Dam, including construction of fish screens, ladders, and traps;
- opening the Red Bluff Diversion Dam gates from December 1 to April 1 to allow unimpeded passage of migrating adult chinook salmon, especially winter-run chinook salmon;
- increasing discharge from Keswick Dam in coordination with the release of smolts from the Coleman National Fish Hatchery;
- releasing water from the low-level outlets on Shasta dam to reduce water temperature to protect winter-run chinook salmon in the Sacramento River;
- releasing cooler Trinity River water from Keswick Dam to protect fall-run chinook salmon in the Sacramento River;

- funding the Shasta temperature-control study and developed plans for installation of a selective withdrawal structure on Shasta dam to provide flexibility in controlling the temperature of released water;

- funding purchase and placement of spawning gravel in the Sacramento River downstream of Keswick Dam;

- releasing water from Shasta Reservoir to dilute toxic runoff from Spring Creek and prevent fish kills in the Sacramento River;

- funding modernization of the Trinity River Fish Hatchery; and

- funding fisheries studies in the Sacramento-San Joaquin Estuary, including real-time monitoring of striped bass movement down the Sacramento River.

Activities undertaken by DWR include:

- installing pumps on Mill Creek to provide groundwater for agricultural irrigation in lieu of diversions during the migration of adult and juvenile spring-run chinook salmon;

- restoring and replacing spawning gravel on Mill Creek, the upper Sacramento River, Merced River, and Tuolumne River;

- funding the modernization of Merced River Fish Hatchery;

- purchasing striped bass and steelhead juveniles to replace losses to entrainment in SWP diversions; and

- funding Delta smelt and striped bass studies and population monitoring.

ENVIRONMENTAL CONSEQUENCES

Methodology

Impacts of the alternatives were evaluated relative to conditions simulated for the No-Action Alternative. The existing conditions for fish populations are described above in the "Affected Environment" section.

A detailed discussion of the methodology and associated assumptions used to assess fisheries impacts is provided in the Stage 2 EIR/EIS Technical Report (bound separately). Hydrologic data used in the impact analysis were output from the DWRSIM and FDM models.

Impacts of the project alternatives were compared to existing conditions to determine impact significance using the criteria described in the following section. Impacts of No-Action Alternative operations were also compared to impacts under existing conditions. Impacts of the project alternatives under future conditions were compared to both existing conditions and No-Action Alternative conditions. When the incremental impacts under future project alternative conditions were the same or greater than impacts under No-Action Alternative conditions, an analysis of their significance was conducted. The impact analysis under future conditions is, by its nature, a cumulative impact analysis. The "Approach to Hydrologic Modeling" section in Chapter 1 provides a complete explanation of this impact analysis approach.

Mitigation measures to reduce significant adverse impacts to less-than-significant levels were identified for three conditions: project alternatives under existing conditions, No-Action Alternative conditions, and future project alternative conditions. Most of the impacts identified under future conditions were attributable to changes that resulted from future No-Action Alternative conditions. Measures to mitigate these impacts are described, along with measures to reduce any incremental increased impacts attributable to the project alternatives. To completely mitigate a specific impact identified under future project alternative conditions, the mitigation measures identified for that impact under No-Action Alternative conditions would need to be implemented along with the measures identified for the incremental project alternative impact. Implementation of mitigation for project alternative impacts would reduce or avoid the incremental impact attributable to the project alternative and would be the responsibility of CCWD. Mitigating the remaining cumulative impact would be the responsibility of other agencies. Impacts discussed under the cumulative future scenario are treated similarly.

The alternatives considered in this EIR/EIS could affect fish and habitat in the Delta; Bay; Trinity, Sacramento, and American Rivers; and Clair Engle, Shasta, and Folsom Reservoirs. The major species or species groups included in the impact analysis were chinook salmon, striped bass, Delta smelt, American shad, and Bay species. Adverse and beneficial impacts were identified for these species because of their importance to commercial and sport fisheries, the sensitivity of the species to environmental conditions affected by water project operations, and the historical decline in their populations attributable to habitat loss and degradation. Adverse and beneficial impacts of operation of the alternatives on species described in the impact analysis generally apply to all species with similar distributions and life histories.

Although CCWD is considering constructing a new supplemental intake facility at one of five possible locations (four along Old River and one at Clifton Court Forebay), the impacts of each location on fisheries would be essentially identical and are therefore discussed together below.

Criteria for Conclusions of Significance

Populations of fish and other aquatic organisms may be reduced because of increased mortality and changes in habitat availability and suitability that affect species survival, growth, migration, and reproduction. Impacts on fish populations generally are considered significant when operation of the alternatives would cause or contribute to substantial short- or long-term population reductions.

Whether a particular reduction in population is considered substantial depends on the population status, dynamics of the population under investigation, and the total impact of similar project and nonproject conditions on the population. Impacts on special-status species, including federally listed and state-listed threatened and endangered species, may be considered significant if operation of an alternative would increase mortality, reduce growth and reproductive success, or reduce habitat availability and suitability. For species that are substantially affected by existing conditions (e.g., striped bass), impacts may be significant if the conditions contributing to existing effects are substantially worsened by project alternative operations.

For some species, a substantial reduction (greater than 25%) in a life stage's abundance may not be a significant adverse impact on the population. The level of significance depends on the ability of the species to maintain or exceed current production levels through mechanisms that compensate for reduced abundance of earlier life stages. Many fish populations are resilient, even with mortality induced by human activities, and can sustain high levels of exploitation (e.g., entrainment losses) (Van Winkle 1977). All available data, including past responses of the population to changes in environmental conditions and direct mortality, were evaluated to determine the significance of adverse impacts.

No-Action Alternative

Under No-Action Alternative conditions, demands for water from the Sacramento River, San Joaquin River, and other rivers by all users are assumed to increase. The following assessment identifies the potential fisheries impacts of this increased future demand under the No-Action Alternative. The impacts identified for the No-Action Alternative are unrelated to the project alternatives.

Effects of Delta Cross Channel Diversions on Migration and Survival

Survival of juvenile fish drawn into the Delta Cross Channel and Georgiana Slough is lower than survival of juvenile fish continuing down the Sacramento River. Increased predation and entrainment in diversions further reduces the survival rate.

Relative to existing conditions, model simulations indicate that an increased diversion of Sacramento River water into the Delta Cross Channel and Georgiana Slough would occur more often during September-June, excluding March and April. In March and April, the frequency of increased diversion into the Delta Cross Channel and Georgiana Slough is nearly the same as the frequency of reduced diversion. Although increased flows occur most of the time, up to 95% of the simulated years during May, the increase in the proportion of Sacramento River flow diverted is usually less than 1%.

Chinook Salmon Mortality Index. Mortality of Sacramento River chinook salmon migrants in the Delta is correlated with the proportion of Sacramento River flow drawn into the Delta Cross Channel and Georgiana Slough, total Delta export, and temperature. Under the No-Action Alternative, the estimated mortality of fall-run chinook salmon would increase by 1-2% about 65% of the time (Figure 4-3). The increased mortality caused by drawing additional Sacramento River water through the Delta Cross Channel would have a significant adverse impact on chinook salmon populations in the Sacramento River.

Lower San Joaquin River Flow Effects on Migration and Survival

Relative to existing conditions, the simulated frequency of reverse flows in the lower San Joaquin River increased during November-January, March, and June-September (see Chapter 3, "Delta System Hydrodynamics"). Net lower San Joaquin River outflow decreased during November-March and May-September.

Striped Bass and the Striped Bass Survival Index. Striped bass eggs, larvae, and small juveniles are present in the Delta during April-July. Increased reverse-flow conditions during June and reduced lower San Joaquin River outflow during May-June would retain additional striped bass in the central Delta where survival is reduced. Increased net outflow in the lower San Joaquin River during April and reduced frequency of reverse flow (Figure 4-4) would benefit striped bass spawned in the San Joaquin River.

The striped bass abundance index is an indicator of the effect of overall flow conditions in the Delta on the survival of striped bass. (See the separately bound Stage 2 EIR/EIS Technical Report for methodology and assumptions.)

Under the No-Action Alternative, abundance would increase about 10% of the time and decline about 75% of the time, based on simulated hydrology. Reduced abundance ranges from 1% to 10% during the simulated years (Figure 4-4).

The existing striped bass population has declined substantially from historical levels. Reduced survival would cause additional stress on the population, and additional reductions in net outflow in the lower

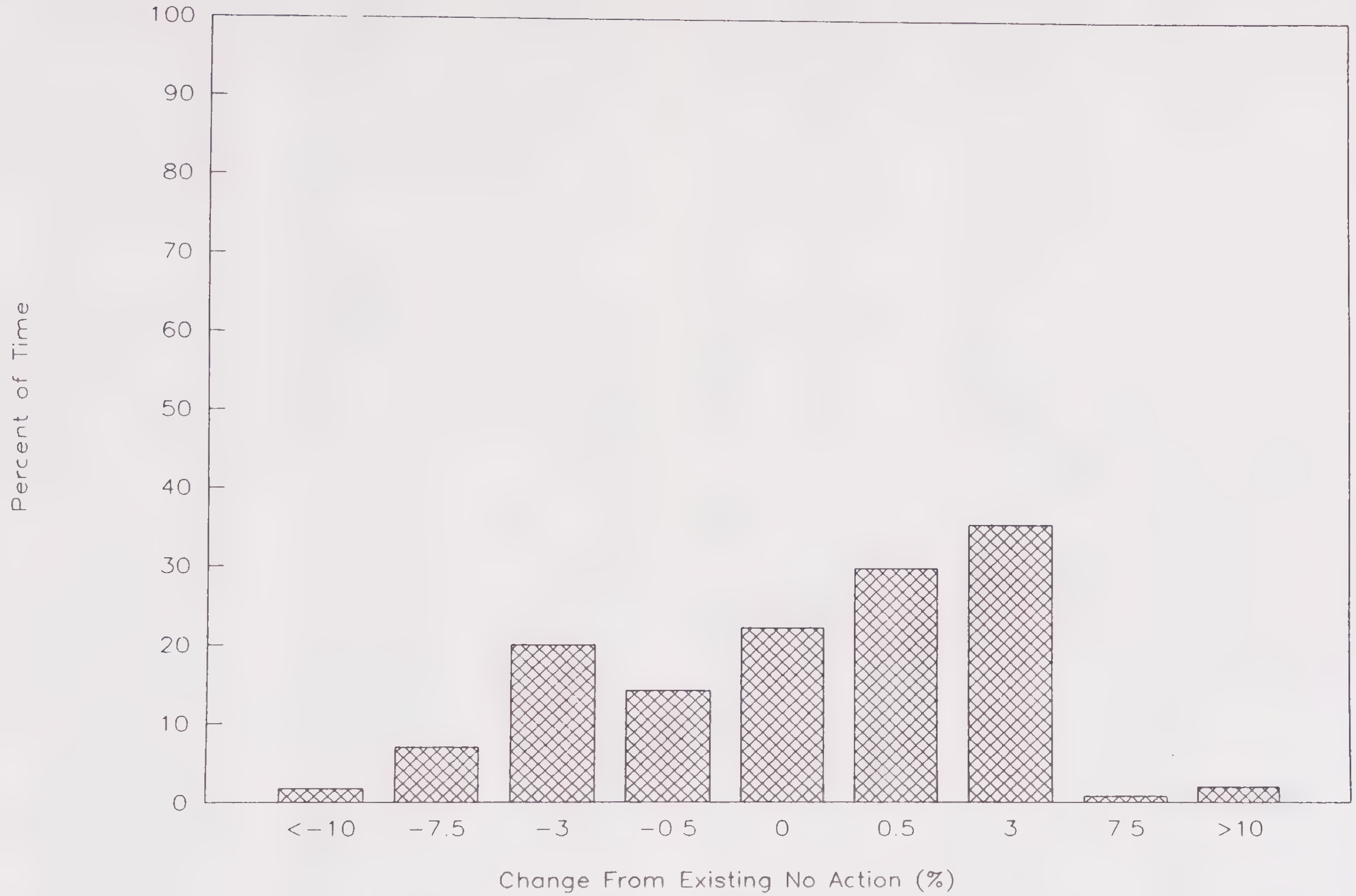


Figure 4-3. Change in Juvenile Chinook Salmon Mortality Rate under No-Action Alternative Conditions

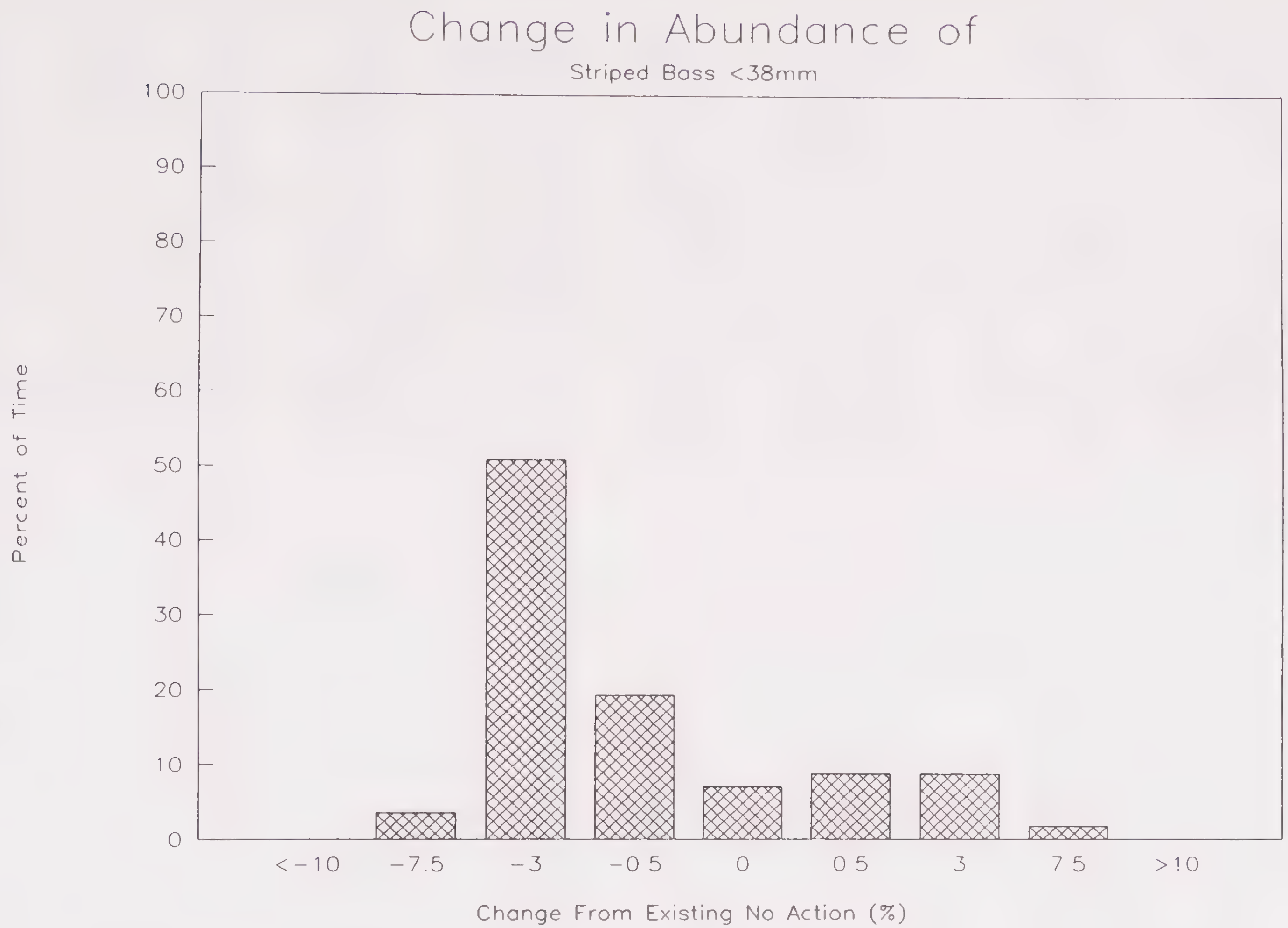


Figure 4-4. Change in Striped Bass Abundance Index under No-Action Alternative Conditions

San Joaquin River during May-June would, therefore, have a significant adverse impact on the striped bass population.

Delta Smelt. Delta smelt larvae and small juveniles are present in the Delta during March-July. Increased reverse-flow conditions during March and May-July would retain smelt in the central Delta, preventing them from outmigrating to Suisun Bay. Survival of smelt retained in the central Delta would be reduced as compared to those allowed to drift into Suisun Bay. As with striped bass, increased net outflow in the lower San Joaquin River during April and reduced frequency of reverse flow would benefit Delta smelt. The available information on Delta smelt is insufficient to determine the benefit of April flow changes relative to the adverse impacts of May-July flow changes.

The existing Delta smelt population abundance is low relative to historical levels. Assuming that the change in striped bass abundance (Figure 4-4) is indicative of effects on smelt, increased mortality would cause additional stress on the population, and future adverse changes in Delta flow patterns would, therefore, have a significant impact on the Delta smelt population.

Losses from Entrainment

Entrainment in diversion pumps and siphons causes mortality of individuals and primarily affects larvae and juveniles. Most populations can compensate for increased mortality through reduced mortality during later life stages and increased reproductive rates. Populations limited by habitat availability and quality or by low survival rates may be unable to compensate for increased mortality and, therefore, may decline.

The level of entrainment that exceeds a population's ability to compensate for the loss has not been determined for Delta fish populations; however, populations that exhibit low abundance relative to historical levels, such as river-spawned chinook salmon, striped bass, and Delta smelt, could be adversely affected by increased entrainment mortality.

Total Delta diversions via SWP, CVP, and CCWD pumps for the 57-year simulation period increases under the No-Action Alternative, primarily during November-March and May-September. The median increase in diversion relative to existing conditions would range from 2% in May to 27% in March. The proportion of total SWP, CVP, and CCWD diversion attributable to CCWD demand ranges from 1% during winter (December-April) to 3-5% during summer (May-September).

Chinook Salmon. Entrainment of chinook salmon (all runs combined and winter-run) was quantified for simulated diversion over the 1922-1978 hydrologic period (Stage 2 EIR/EIS Technical Report). Quantification does not provide a precise estimate of entrainment but indicates the relative magnitude of the difference between existing and future levels of entrainment.

Annual entrainment under future demands would exceed entrainment under existing conditions (Figure 4-5). Increased entrainment of chinook salmon under future No-Action Alternative conditions would have a significant adverse impact on juvenile abundance.

Entrainment of winter-run chinook salmon under the No-Action Alternative would be reduced because of less April diversion (Figure 4-5). The effects on winter-run chinook salmon would be less than significant.

Striped Bass. Total annual entrainment of striped bass would increase (Figure 4-5). The existing population is significantly affected by entrainment, and this additional population loss, therefore, would be a significant impact.

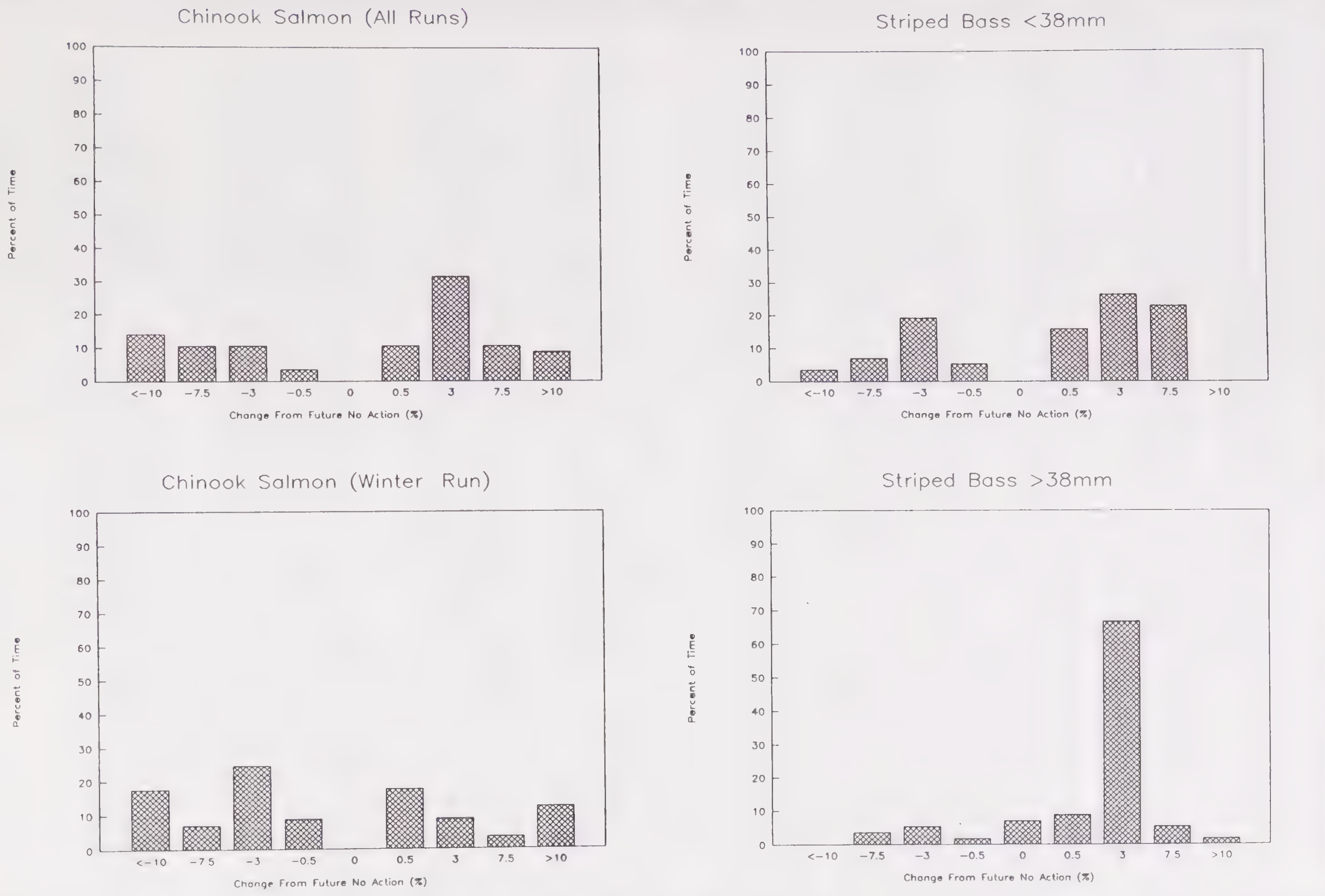


Figure 4-5. Change in Entrainment Loss of Chinook Salmon and Striped Bass under No-Action Alternative Conditions

Delta Smelt. Delta smelt salvage at the Harvey O. Banks Pumping Plant is greatest during May-July. Maximum entrainment potentially occurs during April, when the number of larvae too small to salvage may peak. Diversion would increase during May-July and entrainment of Delta smelt would increase.

Because Delta smelt abundance is low relative to historical levels, increased diversion during May-July would have significant adverse impacts on Delta smelt. Reduced diversion in April under No-Action Alternative conditions would entrain fewer Delta smelt; however, neither net gain nor loss from entrainment for all months can be determined with available data.

American Shad. American shad larvae and small juveniles, the life stages most susceptible to entrainment, are entrained during July-August and are likely the progeny of adults that spawned in the Delta (California Department of Fish and Game 1987e). Outmigrant juvenile shad from the Sacramento River are entrained during October-December.

Most of the shad population spawns upstream of the Delta in the Sacramento River and its tributaries (California Department of Fish and Game 1987e). If entrainment of outmigrant shad during October-December depends on movement into the central Delta via the Delta Cross Channel and Georgiana Slough, then entrainment caused by exposure to increased export under No-Action Alternative conditions would be slightly greater than under existing conditions because Sacramento River flow diverted into the Delta Cross Channel and Georgiana Slough would increase 1-2%.

Impacts of increased entrainment on the American shad population would be less than significant because adult American shad abundance does not appear to be declining because of existing entrainment. Juvenile abundance in the Delta during fall is strongly correlated with high riverflow during spring (April-June), indicating that upstream factors may be controlling population abundance.

Delta Outflow Effects on Migration and Habitat Quality in the Bay

Environmental conditions in the Bay (including Suisun and San Pablo Bays) could be affected by changes in the timing and volume of Delta outflow. The abundance of some species is correlated with Delta outflow, primarily outflow during winter and spring (California Department of Fish and Game 1987f).

Under No-Action Alternative conditions, simulated total annual outflow would be reduced in 352 months of the 684-month (57-year) simulation period. Reduced outflow would occur during October-June, the period when excess flow is generally present in the Delta. The reductions in outflow during January-April would probably have the greatest effect on Bay species. The median reduction in monthly outflow would range from 4% in April to 9% in January. Effects would be greatest when outflow would be less than 20,000 cfs (Figure 4-6).

Species populations that usually become more abundant during years of high outflow (e.g., bay shrimp and longfin smelt) could decline, whereas species populations that generally decline during years of high outflow (e.g., Dungeness crab juveniles and northern anchovy eggs) could increase. Organisms in Suisun Bay and, possibly, San Pablo Bay would be most affected because the change in outflow would be relatively small or would occur at lower outflow volumes. The change in outflow would be relatively small and the net impacts of reduced outflow on overall Bay fish populations would be less than significant.

Flow Effects on Habitat Availability and Migration in Rivers

Trinity River. Trinity River flow under the No-Action Alternative would be nearly identical to flow under existing conditions. Fisheries resources would not be affected.

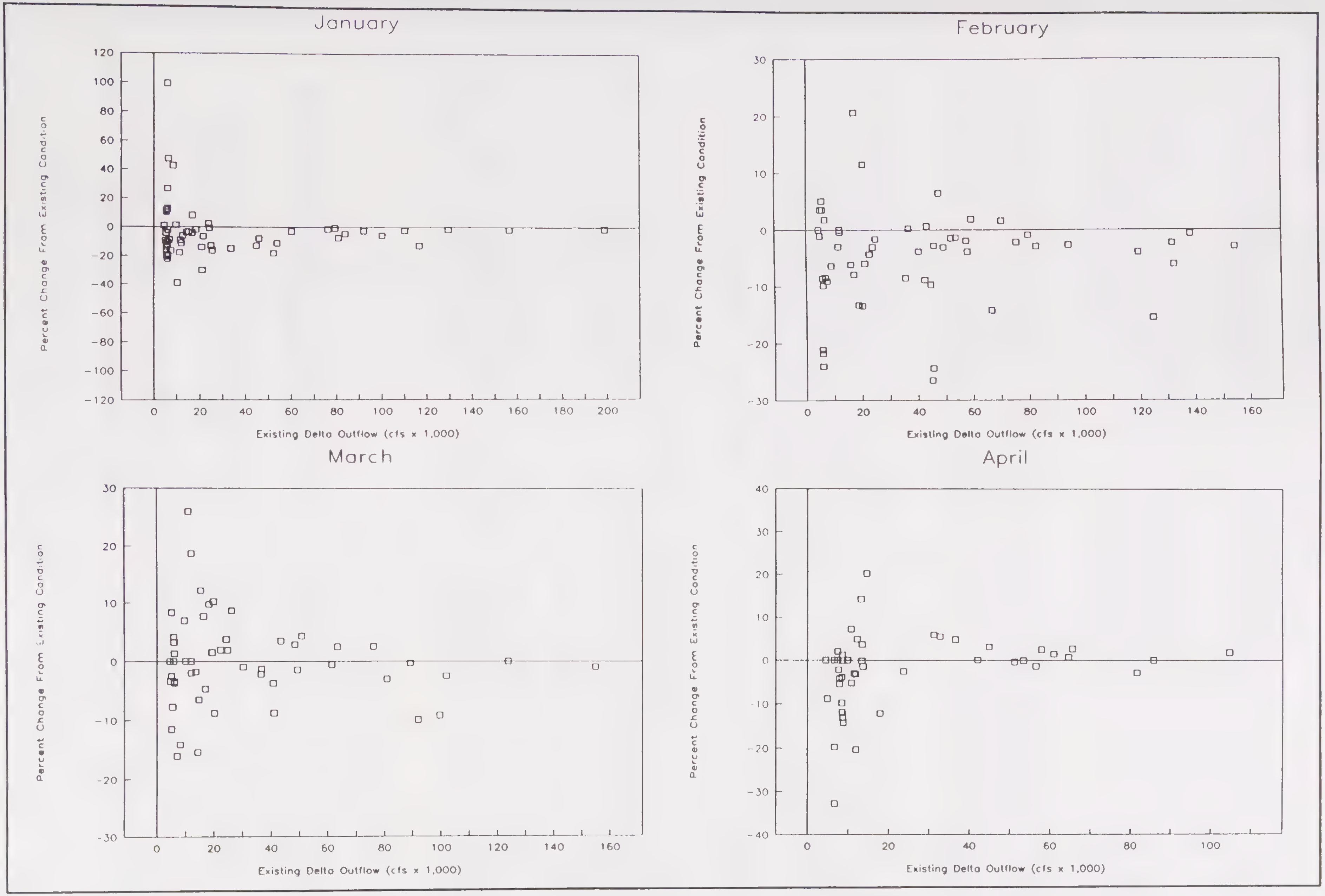


Figure 4-6. Change in Delta Outflow under No-Action Alternative Conditions

Sacramento River. Sacramento River flow would increase during August-December under the No-Action Alternative. The increased flow could provide additional spawning habitat for fall- and spring-run chinook salmon and rearing habitat for other runs.

Sacramento River flow would decline substantially during April and July. During July, fish would not likely be affected because flows typically exceed 10,000 cfs and the reduction in flow would be relatively small (Figure 4-7). During April, however, spawning and rearing late fall-run chinook salmon could be adversely affected because flows are lower and reduction in flow would be relatively large during some years (Figure 4-7).

Sacramento River flows less than 6,000 cfs at Keswick Dam may reduce the availability and quality of chinook salmon habitat (U.S. Fish and Wildlife Service and California Department of Fish and Game 1987). The frequency of flows higher than 6,000 cfs would be greater under No-Action Alternative conditions than under existing conditions during October, March, and September (Figure 4-8), and the frequency of flows less than 6,000 cfs would be higher under the No-Action Alternative during November-January and April (Figure 4-8).

Considering that flows less than 6,000 cfs occur over 50% of the time during November-January under existing conditions and, under future No-Action Alternative conditions, flows generally increase during November and December, the change in flows would have a less-than-significant impact on fall-run chinook salmon. Late fall-run chinook salmon would also experience less-than-significant impacts from flow changes in April because most of the late fall-run spawning would have been completed during January-March and flows during January-March would be less than 6,000 cfs during most years (Figure 4-8).

American River. American River flow under No-Action Alternative conditions would be less than flow under existing conditions during May-January.

The change in flow volume and timing would reduce chinook salmon spawning success 61% of the time but increase rearing success 74% of the time (Figure 4-9). Adverse impacts of reduced spawning success would be less than significant because the spawning index is relatively high, reduction in the index is less than 10% during most years, and much of American River chinook salmon production is hatchery dependent. The increased rearing index may indicate benefits of flow changes on chinook salmon rearing, which could compensate for reduced spawning success.

The number of American shad spawning in the American River under No-Action Alternative conditions could be lower than under existing conditions because flow during May-June would be lower (Figure 4-10). American shad not returning to the American River may spawn in the Sacramento River or its tributaries upstream of the American River, however; impacts on American shad would therefore be less than significant.

Temperature Suitability in Rivers

Survival and growth of chinook salmon and steelhead trout during the spawning and rearing life stages depend on water temperatures in the riverine habitat. Both reservoir storage and discharge volumes can affect the water temperature in rivers.

Trinity River. Trinity River flow under the No-Action Alternative would be nearly identical to flow under existing conditions and temperature would not be affected by flow. No impacts would result.

Sacramento River. During the period when Shasta Reservoir releases affect water temperature (June-October), reduced flows occur only during July. The effect of flow change on temperature during July would likely be minimal because flow would exceed 10,000 cfs most of the time (Figure 4-7).

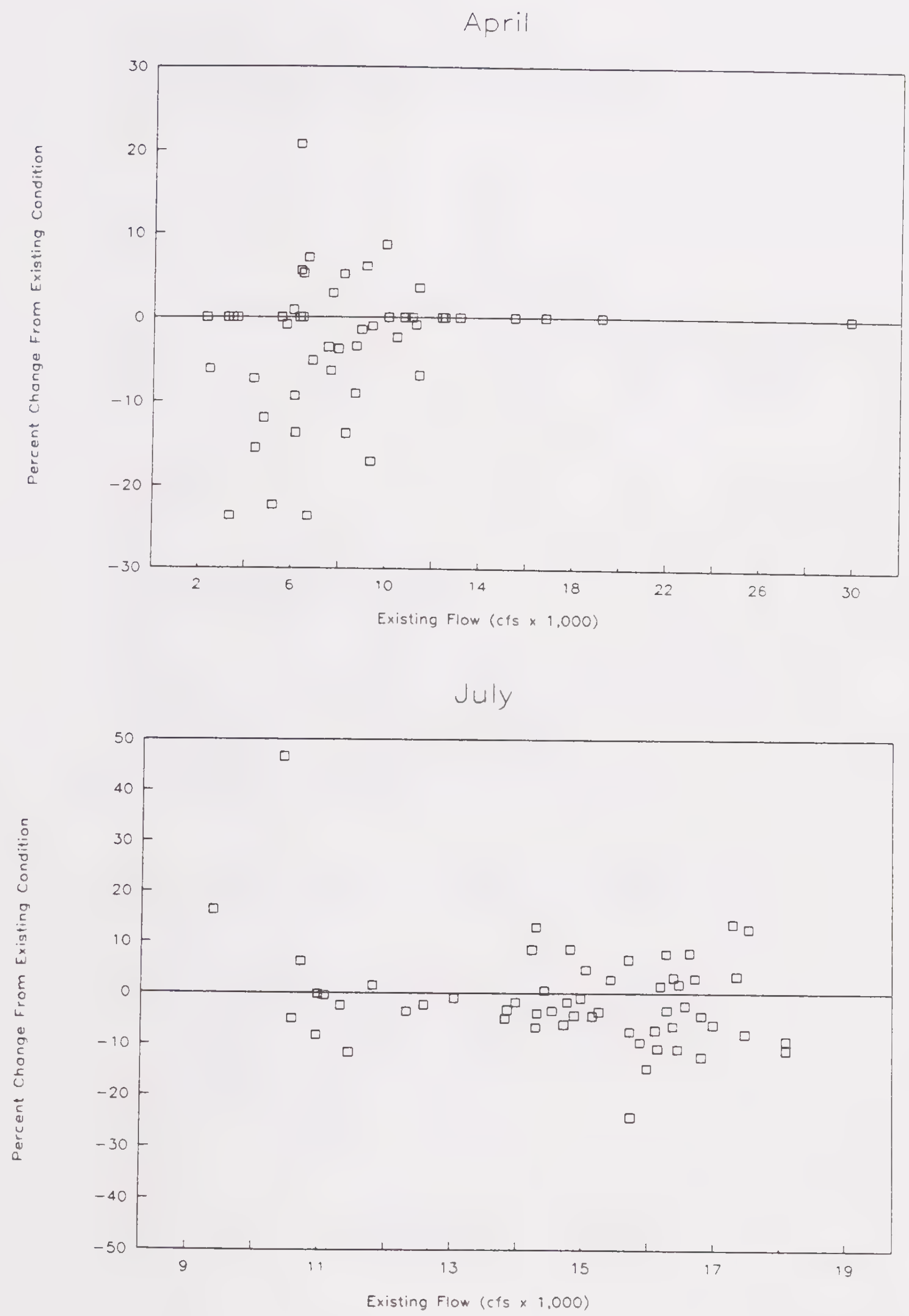


Figure 4-7. Change in Sacramento River Flow under No-Action Alternative Conditions

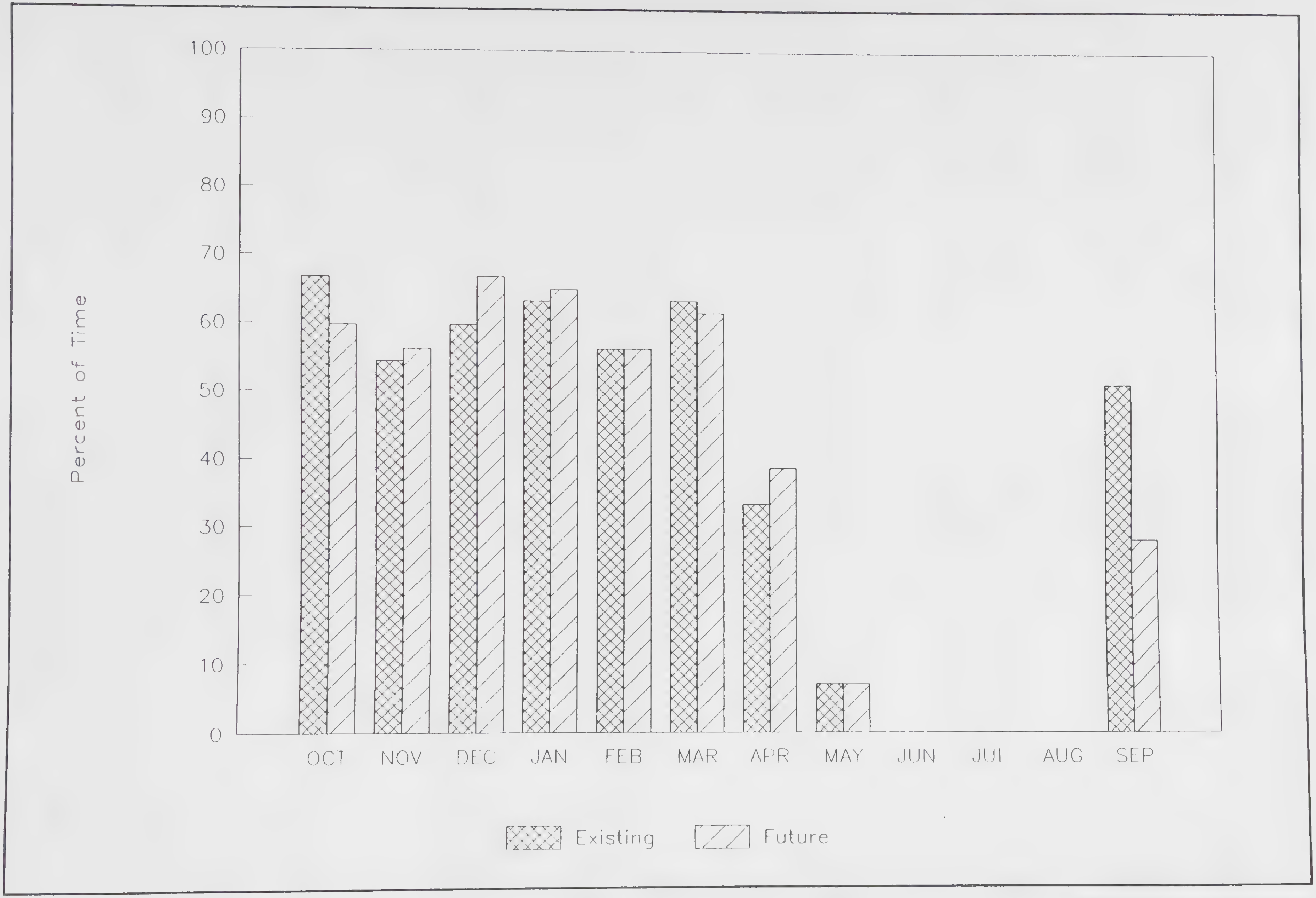


Figure 4-8. Sacramento River Flow Less than 6,000 cfs under No-Action Alternative Conditions

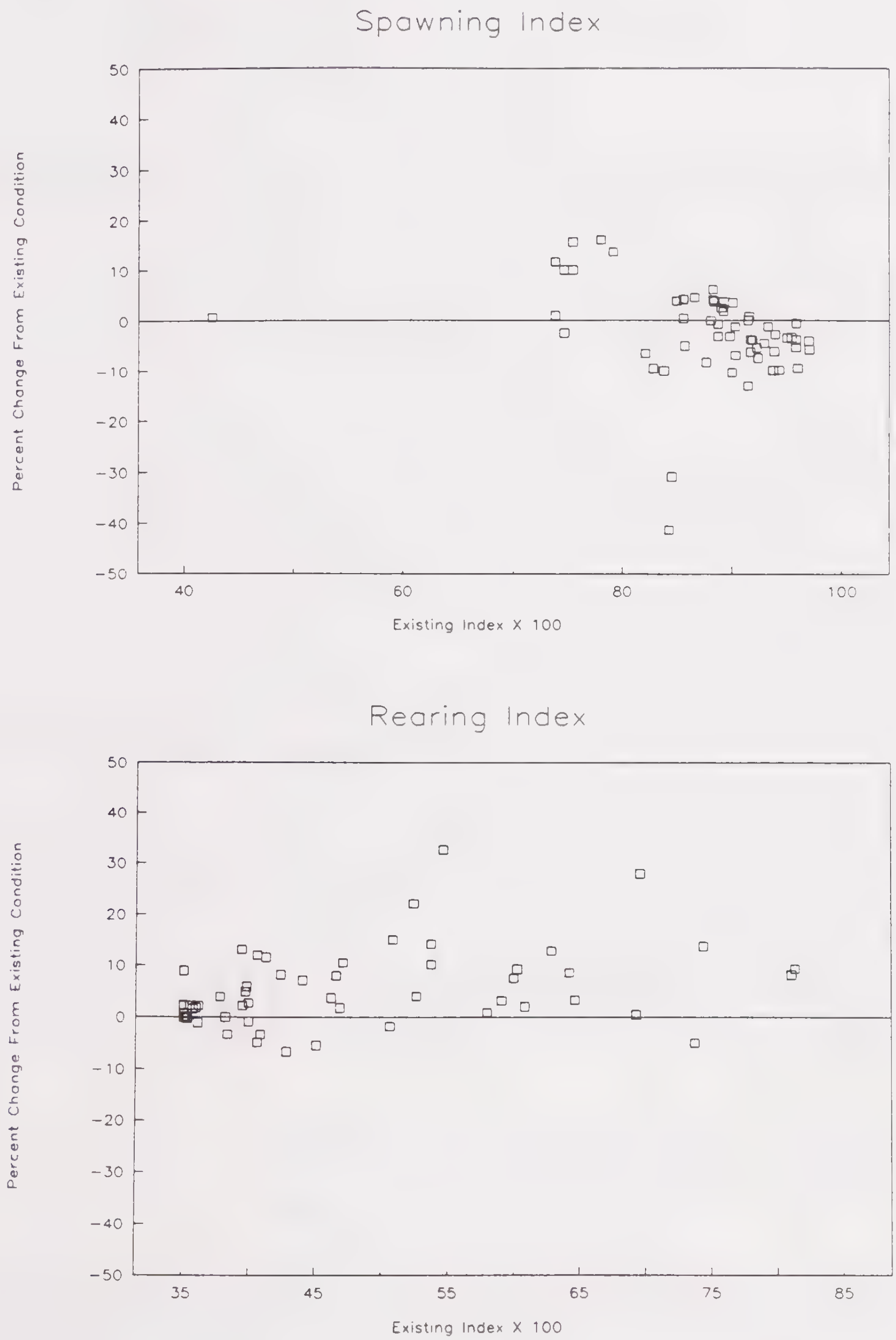


Figure 4-9. Change in Spawning and Rearing Indices for Chinook Salmon in the American River under No-Action Alternative Conditions

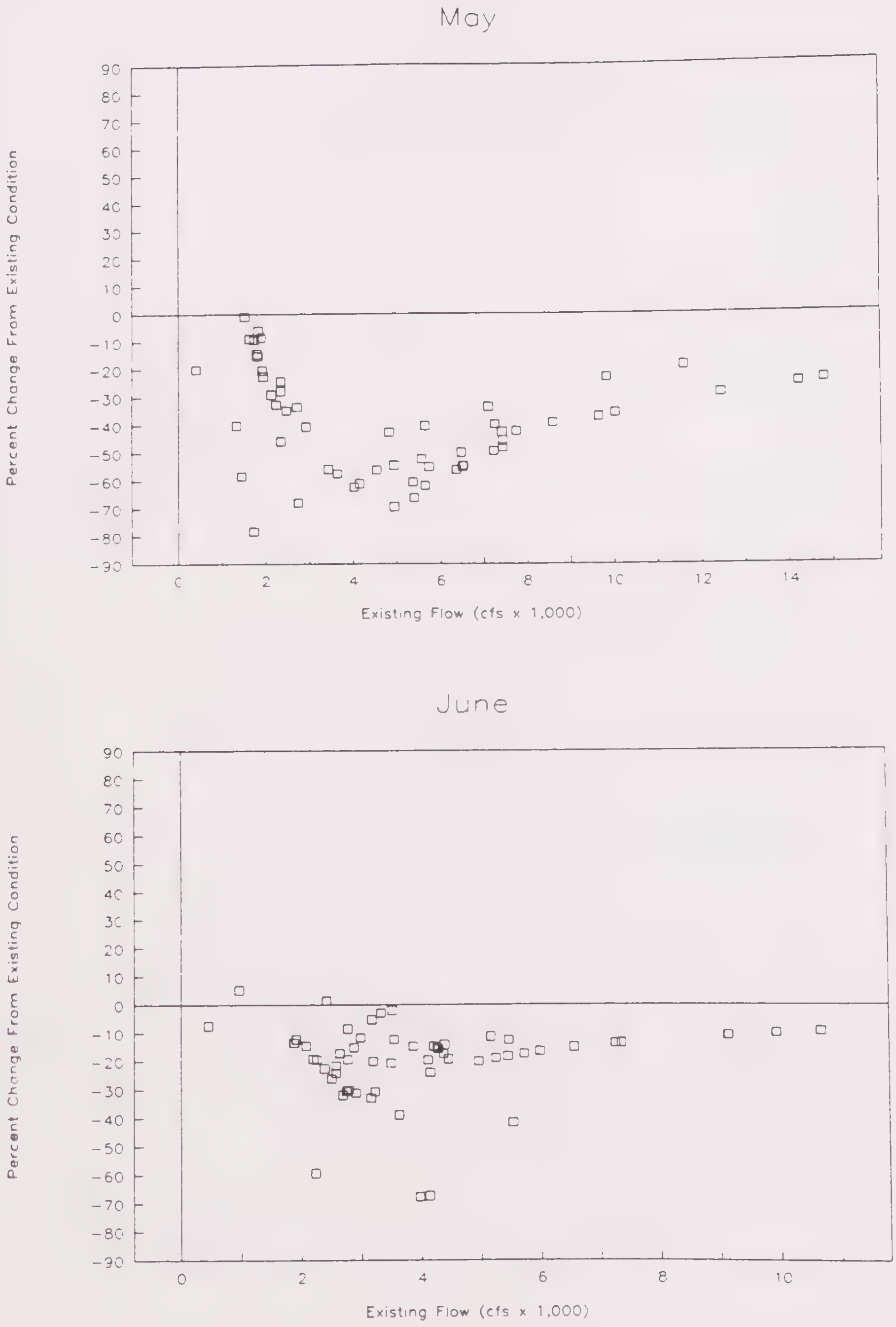


Figure 4-10. Change in American River Flow under No-Action Alternative Conditions

Suitable Sacramento River water temperatures can usually be maintained when storage in Shasta Reservoir is greater than 2 million af during July-September. Reservoir storage under the No-Action Alternative would typically be lower than under existing conditions. Storage of less than 2 million af was simulated about 23% of the time under existing conditions and 39% of the time under No-Action Alternative conditions. The change in storage would likely result in releasing water of a higher temperature into the Sacramento River. Existing temperature conditions in the Sacramento River adversely affect winter-, spring-, and fall-run chinook salmon. Increased water temperatures under No-Action Alternative conditions would cause significant adverse impacts on all three runs.

American River. Relative to existing conditions, flows under the No-Action Alternative would be lower during May-January. Lower flow could cause increased temperatures during May-October and adversely affect rearing (May-June) and spawning (September-October) success of chinook salmon.

Lower storage in Folsom Reservoir could result in higher release temperatures during September-November and worsen temperature conditions. Increased temperatures resulting from lower reservoir storage and lower flows under No-Action Alternative conditions would have significant adverse impacts on the survival of chinook salmon spawning in the American River.

Operations Effects on Fish Productivity in Reservoirs

Fish productivity in CVP reservoirs is limited by water level fluctuations that result from operations for flood control, water supplies, and hydroelectric power generation.

Declining water levels adversely affect the spawning success of sunfish and bass (centrarchids) in reservoirs. Centrarchid spawning occurs primarily during March-August in water less than 20 feet deep.

Clair Engle Reservoir. Reservoir storage would be lower under No-Action Alternative conditions. Storage, however, would be only 1-2% lower during most simulated years compared to existing conditions and reservoir fisheries would not likely be affected.

Shasta Reservoir. Shasta Reservoir storage would be 3-9% lower under No-Action Alternative conditions. The simulated frequency and magnitude of declining water levels would be nearly the same under existing and future conditions. Simulated reservoir operations under No-Action Alternative conditions would have a less-than-significant adverse impact on fish productivity in Shasta Reservoir.

Folsom Reservoir. Folsom Reservoir storage would be 8-21% lower under No-Action Alternative conditions. Water-level declines would occur slightly more often. Fish productivity in Folsom Reservoir may decline and the adverse impact of future demands on fish productivity would be significant.

Los Vaqueros Reservoir Alternative

Intake Facility Construction on Old River

Effects of Intake Construction on Fish Survival. Construction activities could temporarily add suspended sediments to Delta waterways. Increased suspended sediments could adversely affect feeding and possibly reduce spawning and rearing habitat quality. Depending on timing of construction activities, increased sediment input could have a significant adverse impact on fish in habitats adjacent to the construction site.

Effects of Structural Changes at the Intake Facility Site on Fish Habitat. Fish habitat in the Delta has been severely modified and degraded through channelization and bank stabilization. Levee modification

and channel stabilization at the intake sites could remove existing aquatic vegetation and reduce habitat structural variability. Structural changes to the levees and banks at the intake site could have significant adverse impacts on local populations of resident species, such as catfish and largemouth bass.

Effects of Delta Cross Channel Diversions on Migration and Survival

Existing Conditions with Project. Simulated increased Delta Cross Channel diversion of 23% occurred during April of 2 years of the 57-year simulation. The increases resulted when Delta outflow criteria were met and the FDM simulated opening the Delta Cross Channel gates. Actual Delta outflow is not measured and minor flow changes under actual operations would not cause opening and closing of the Delta Cross Channel gates.

Los Vaqueros Reservoir Alternative operations would have little effect on the proportion of Sacramento River flow drawn into the Delta Cross Channel and Georgiana Slough; therefore, this impact would be less than significant.

Future Conditions with Project. Under the Los Vaqueros Reservoir Alternative relative to existing conditions, simulated increased flow into the Delta Cross Channel and Georgiana Slough occurred most of the time during September-June; however, the increase in the proportion of Sacramento River flow is usually less than 1%. The increase in the proportion of diverted Sacramento River water attributable to Los Vaqueros Reservoir Alternative operations under future conditions is much less than 1%.

Chinook Salmon Mortality Index

Existing Conditions with Project. Although mortality would increase slightly (much less than 1%) under the Los Vaqueros Reservoir Alternative (Figure 4-11), the population would experience less-than-significant impacts because only salmon that entered the central Delta would be affected and Los Vaqueros Reservoir Alternative operations would not increase the number of chinook salmon juveniles diverted into the central Delta from the Sacramento River. The relatively large increase in mortality (3-4%) during 2 simulated years (existing conditions) would not likely occur and is attributable to the model-simulated opening of the Delta Cross Channel gates as discussed above.

Future Conditions with Project. The Los Vaqueros Reservoir Alternative would slightly increase the chinook salmon mortality rate because it would slightly increase the number of outmigrant chinook salmon juveniles that would enter the central Delta as compared to the No-Action Alternative. Because of its small magnitude, this project-related impact would be less than significant.

The Los Vaqueros Reservoir Alternative would, however, contribute slightly to significant Delta-wide cumulative impacts.

Measures to reduce movement of Sacramento River fish into the central Delta are discussed in a following section, "Mitigation Measures", under "No-Action Alternative".

Lower San Joaquin River Flow Effects on Migration and Survival

The frequency of reverse flows under the Los Vaqueros Reservoir Alternative would be the same as under existing conditions. The change in San Joaquin River net flow volume from existing conditions would be less than 1% during most years. During June-October of dry year-types and some below-normal year-types, net San Joaquin River outflow would increase under the Los Vaqueros Reservoir Alternative.

Relative to existing conditions, the simulated frequency of reverse flows increased during November-January, March, and June-September under both future Los Vaqueros Reservoir Alternative operations and

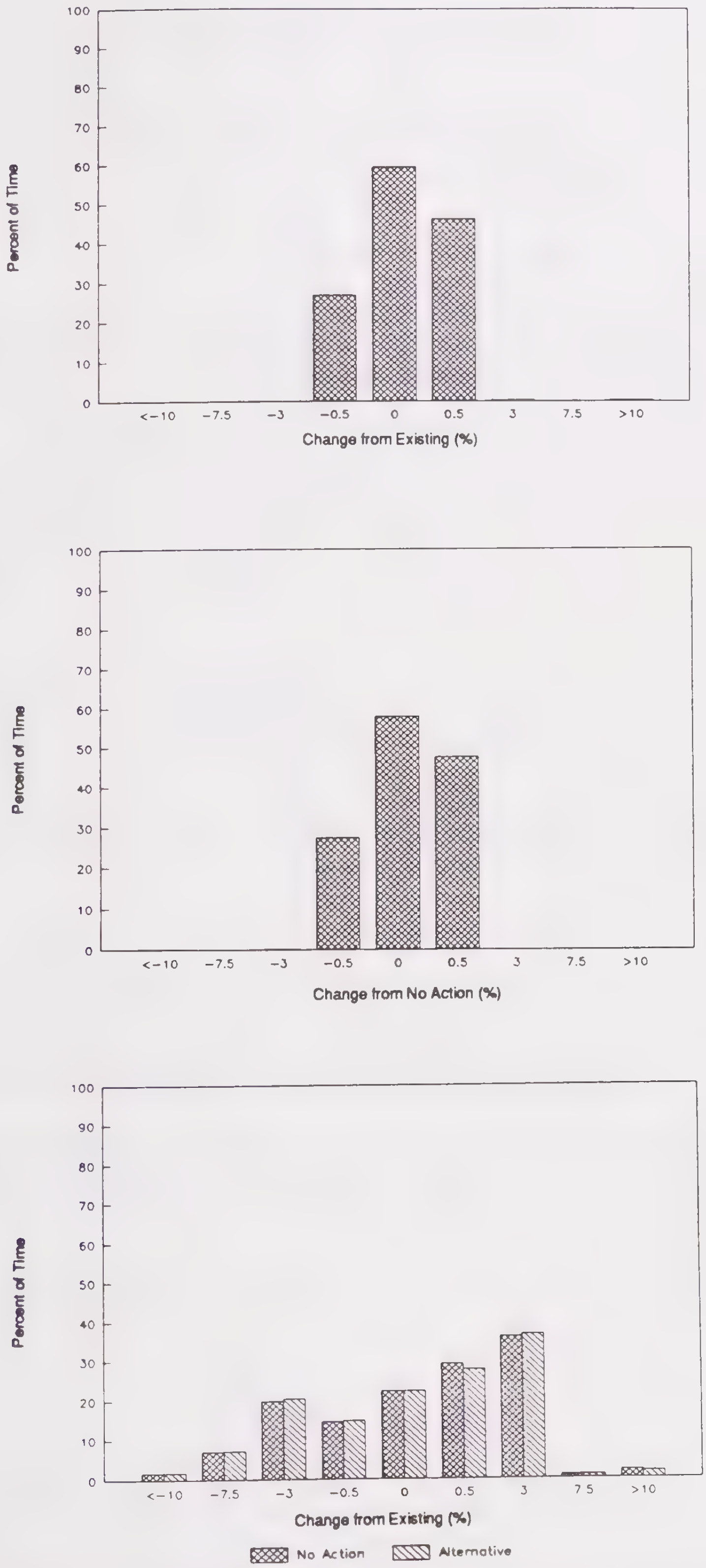


Figure 4-11. Change in Juvenile Salmon Mortality Rate under Los Vaqueros Reservoir Alternative Operations

No-Action Alternative conditions. Net lower San Joaquin River outflow decreased during November-March and May-September.

Relative to the No-Action Alternative, the frequency of reverse flow and change in net lower San Joaquin River outflow under future Los Vaqueros Reservoir Alternative operations would be the same as described above for existing conditions.

Striped Bass and the Striped Bass Survival Index

Existing Conditions with Project. Operation of the Los Vaqueros Reservoir Alternative under existing conditions would slightly reduce lower San Joaquin River outflow during April-June of most years and would retain additional striped bass in the central Delta where the survival rate is reduced.

The striped bass abundance index (see the Stage 2 EIR/EIS Technical Report for methodology and assumptions) indicates the effect of overall flow conditions in the Delta during May-June on survival of striped bass. Operations of the Los Vaqueros Reservoir Alternative under existing conditions would cause a slight reduction in the striped bass abundance index relative to existing conditions (Figure 4-12).

This slight impact would be less than significant, however, because it would not result in a measurable effect on the striped bass population.

Future Conditions with Project. As under existing conditions, Los Vaqueros Reservoir Alternative operations would cause a slight reduction in the striped bass abundance index compared to the No-Action Alternative. This project-related impact would be less than significant for the reasons described above under "Existing Conditions".

The Los Vaqueros Reservoir Alternative would, however, contribute slightly to significant Delta-wide cumulative impacts on striped bass abundance.

Delta Smelt

Existing Conditions with Project. Los Vaqueros Reservoir Alternative operations would result in minor reductions in lower San Joaquin River outflow during April-July, and could detain additional Delta smelt in the central Delta where survival rates are lower. This impact would be less than significant, however, because it would not result in a measurable impact on the Delta smelt population.

Future Conditions with Project. As under existing conditions, Los Vaqueros Reservoir Alternative operations would result in minor reductions in lower San Joaquin River outflow compared to No-Action Alternative conditions. This impact would be less than significant for the reasons described above under "Existing Conditions".

The Los Vaqueros Reservoir Alternative would, however, contribute slightly to significant Delta-wide cumulative impacts on Delta smelt survival.

Losses to Entrainment

Operation of the Los Vaqueros Reservoir Alternative would increase the long-term average total annual CCWD diversion by 2-3% relative to diversions under existing and No-Action Alternative conditions. The timing of diversion would also change. Relative to existing and No-Action Alternative conditions, increased diversion would occur during November-April and reduced diversion would occur during July-October. Diversion during May-June would vary from year to year, but overall diversion would be greater during May and less during June.

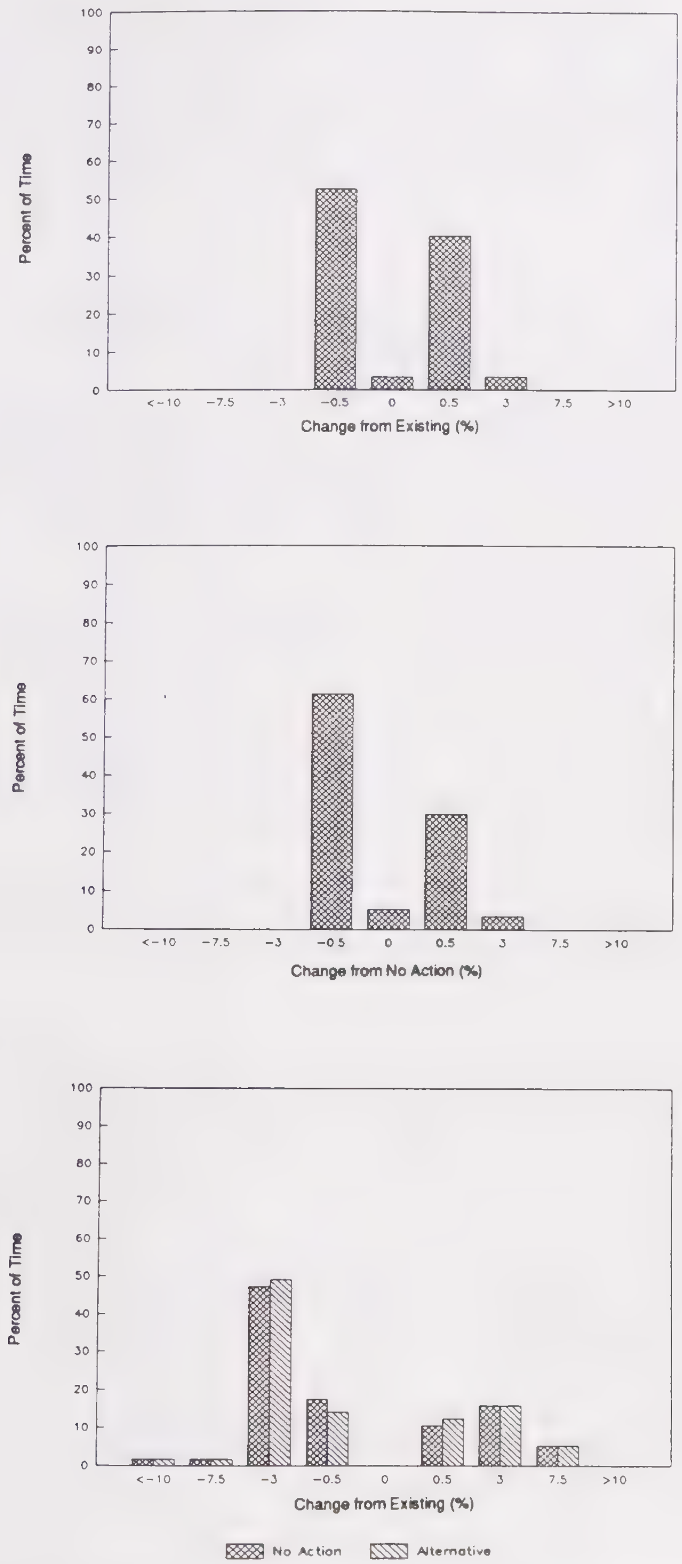


Figure 4-12. Change in Striped Bass Abundance Index under Los Vaqueros Reservoir Operations

Fish Screen Design. Fish screens would be constructed at the new intake location and would slightly reduce overall entrainment losses of fish large enough to be screened. Preliminary screen design is discussed in Chapter 2, "Alternatives Including the Proposed Action". The Delta is a complicated environment and development of the final fish screens would require modification during the planning, construction, and postconstruction (during initial project operation) periods. Models may be used in development of screen design. CCWD would work with the NMFS and DFG engineers during design, construction, and modification of the fish screens.

Chinook Salmon

Existing Conditions with Project. The Los Vaqueros Reservoir Alternative would not change overall losses of chinook salmon to entrainment, primarily because of fish screens on the new diversions and shifts in the diversion pattern. No impacts would result.

Future Conditions with Project. Under No-Action Alternative conditions, overall losses of chinook salmon to entrainment in diversion would increase relative to existing conditions. Under future Los Vaqueros Reservoir Alternative operations, entrainment losses relative to the No-Action Alternative would be less (Figure 4-13).

Because entrainment loss would be less under Los Vaqueros Reservoir Alternative operations than under No-Action Alternative conditions, impacts on chinook salmon would be beneficial.

Winter-Run Chinook Salmon

Existing and Future Conditions with Project. Winter-run chinook salmon loss to entrainment in diversion would be less under both existing and future Los Vaqueros Reservoir Alternative operations (Figure 4-13), primarily because of screening of the new diversions.

Reduced entrainment of winter-run chinook salmon under existing and future conditions would have a slight beneficial impact on juvenile abundance because the proportion of the population exposed to adverse effects in the south and central Delta would not change.

Striped Bass

Existing and Future Conditions with Project. Under the Los Vaqueros Reservoir Alternative, entrainment of striped bass in diversions would be higher during most simulated years for bass less than 38 millimeters (mm) long and lower for bass greater than 38 mm long than under existing conditions (Figure 4-13). Under No-Action Alternative conditions, overall losses of striped bass to entrainment in diversions also would increase.

Screening the new supplemental intake facility would protect juvenile striped bass greater than 38 mm long that otherwise would be entrained in the unscreened Rock Slough diversion where all CCWD diversion would occur under existing and No-Action Alternative conditions.

Impacts from entrainment of striped bass under both existing and future conditions would be less than significant because the net effect on the striped bass population would not be measurable. The Los Vaqueros Reservoir Alternative would, however, contribute slightly to significant Delta-wide cumulative impacts on striped bass from entrainment losses.

Delta Smelt

Existing Conditions with Project. CCWD diversions under the Los Vaqueros Reservoir Alternative would increase during April-May, and occasionally June, compared to existing conditions. Increased CCWD diversion would occur mostly during wetter years. In drier years, CCWD diversions in May-

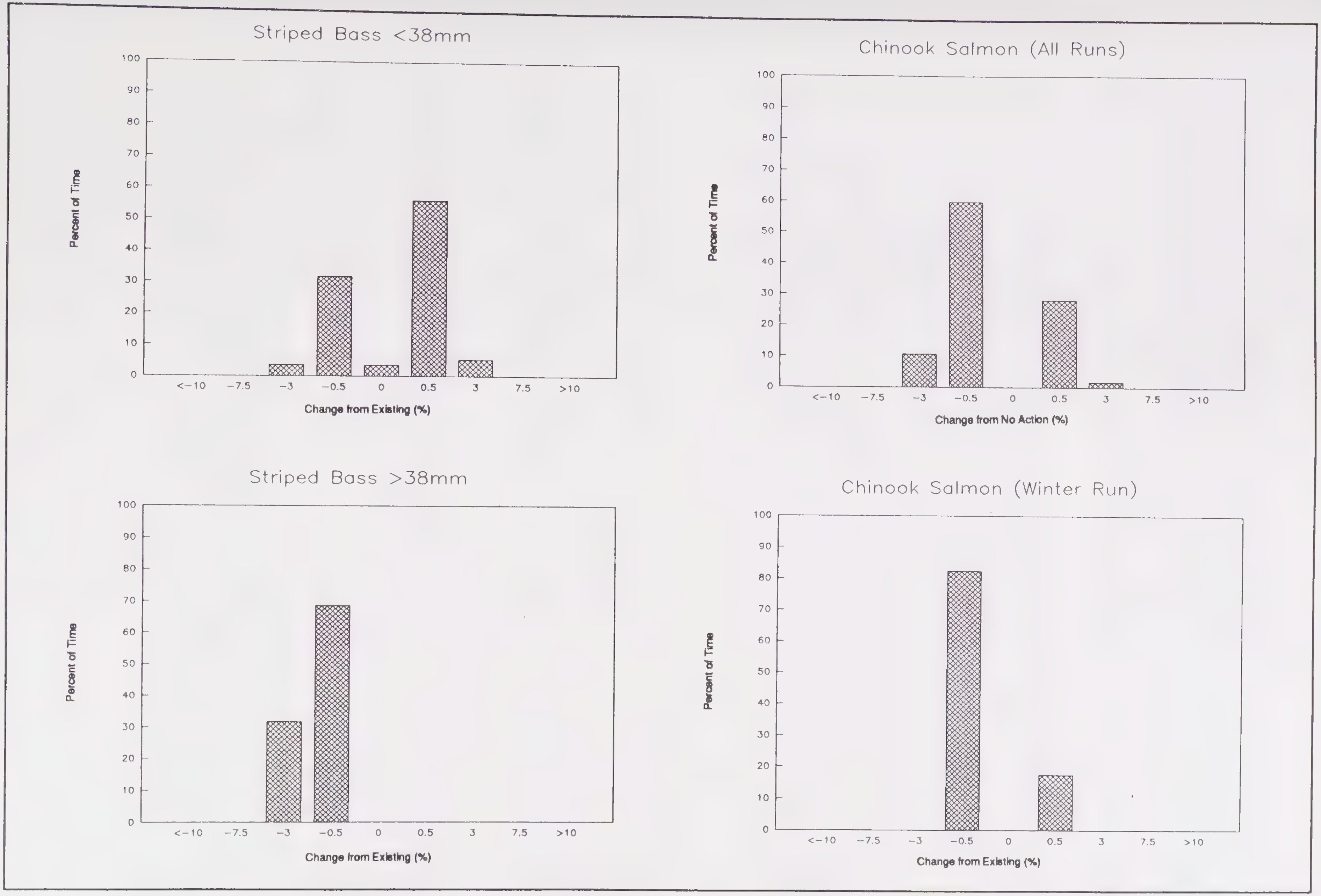


Figure 4-13. Change in Entrainment Losses under Los Vaqueros Reservoir Alternative Operations under Future Conditions

June would be less under Los Vaqueros Reservoir Alternative operations than under existing conditions. Delta smelt densities in the central and south Delta, and therefore entrainment vulnerability, are likely higher during dry years. Impacts of increased diversion during wetter years would therefore be largely offset by decreases in diversion (and presumably entrainment) during drier years. Impacts would therefore be less than significant.

Future Conditions with Project. Impacts under future conditions would be essentially identical to these described above under "Existing Conditions", and project-related impacts would be less than significant compared to the No-Action Alternative.

The Los Vaqueros Reservoir Alternative would, however, contribute slightly to significant Delta-wide cumulative impacts on Delta smelt from entrainment losses.

American Shad

Existing and Future Conditions with Project. During most of the period that American shad occur in the Delta (e.g., July-August), CCWD diversion would be lower under Los Vaqueros Reservoir Alternative operations than under existing and No-Action Alternative conditions, and fewer American shad would be entrained. Increased American shad entrainment would occur during November-December, when juvenile shad outmigrate down the Sacramento River. If entrainment of outmigrant American shad in the Sacramento River is dependent on movement into the central Delta via the Delta Cross Channel and Georgiana Slough, then increased entrainment of American shad would not be expected because the new intake would be screened and Los Vaqueros Reservoir Alternative operations would have little effect on the proportion of Sacramento River flow drawn into the Delta Cross Channel and Georgiana Slough. This impact would therefore be less than significant.

Delta Outflow Effects on Migration and Habitat Quality in the Bay

Delta outflow under the Los Vaqueros Reservoir Alternative would be lower than outflow under existing conditions 25-50% of the time during winter and spring.

Under the No-Action Alternative, total annual outflow would be reduced 93% of the time relative to existing conditions. Operations under the Los Vaqueros Reservoir Alternative would further reduce outflow relative to the No-Action Alternative 25% of the time during winter and spring. Reductions in outflow during January-April could have the most effect on Bay species.

The median reduction in monthly outflow attributable to Los Vaqueros Reservoir Alternative operations would be less than 1%. The change in outflow attributable to this alternative would have little effect on organisms in the Bay. Given existing information, impacts on Bay species would be less than significant (see the same section under "No-Action Alternative".)

Flow Effects on Habitat Availability and Migration in Rivers

Flow in the Trinity River would not change under the Los Vaqueros Reservoir Alternative. Flow in the Sacramento and American Rivers would change, but the changes would be small.

Sacramento River. The frequency of flows less than 6,000 cfs would be the same for operations under the Los Vaqueros Reservoir compared to existing conditions and the No-Action Alternative; chinook salmon in the Sacramento River would not, therefore, be affected by flow changes attributable to the Los Vaqueros Reservoir Alternative. No impacts would result.

American River. In the American River, spawning and rearing indices are nearly the same for flow under operations of the Los Vaqueros Reservoir Alternative and operations under existing conditions and the No-Action Alternative (Figures 4-14 and 4-15). During 1 simulated year (a dry year), the spawning index was about 30% lower than under existing conditions. Adverse impacts of reduced spawning success wouldbe less than significant because the spawning index would be relatively high and a simulated reduction in the spawning index would occur only once in the 57-year simulation period.

Temperature Suitability in Rivers

As discussed above, the Los Vaqueros Reservoir Alternative would have little effect on flow in the Trinity, American, and Sacramento Rivers. The slight increase in reservoir storage at Clair Engle, Shasta, and Folsom Reservoirs under both existing and future operations of the Los Vaqueros Reservoir Alternative relative to existing conditions and the No-Action Alternative could improve temperature suitability in the rivers, although the effect of small increases in reservoir storage would not be measurable. Although minor, this impact would be beneficial.

Operations Effects on Fish Productivity in CVP Reservoirs

CVP operations under the Los Vaqueros Reservoir Alternative would result in slightly greater reservoir volumes, which could have a slight positive effect on reservoir fisheries. This impact would be beneficial.

Kellogg Reservoir Alternative

Kellogg Reservoir would have the same storage capacity as Los Vaqueros Reservoir. Timing and volume of diversions from the Delta would be the same as under the Los Vaqueros Reservoir Alternative.

The effects on fisheries resources in the Delta and in affected areas of the CVP would be identical to effects described for the Los Vaqueros Reservoir Alternative under existing and future conditions. Refer to the "Los Vaqueros Reservoir Alternative" section above for a complete description of impacts.

Desalination/EBMUD Emergency Supply Alternative

Improvements to Rock Slough Intake Facilities

Effects of Intake and Discharge Construction on Fish Survival. Impacts would be the same as described above in the "Effects of Intake Construction on Fish Survival" section under "Los Vaqueros Reservoir Alternative".

Effects of Structural Changes at the Intake and Brine Discharge Sites on Fish Habitat. Impacts would be the same as described above in the "Effects of Structural Changes at the Intake Site on Fish Habitat" section under "Los Vaqueros Reservoir Alternative". Structural changes in habitat could occur at the Rock Slough intake and at the brine discharge point into Suisun Bay west of Pittsburg.

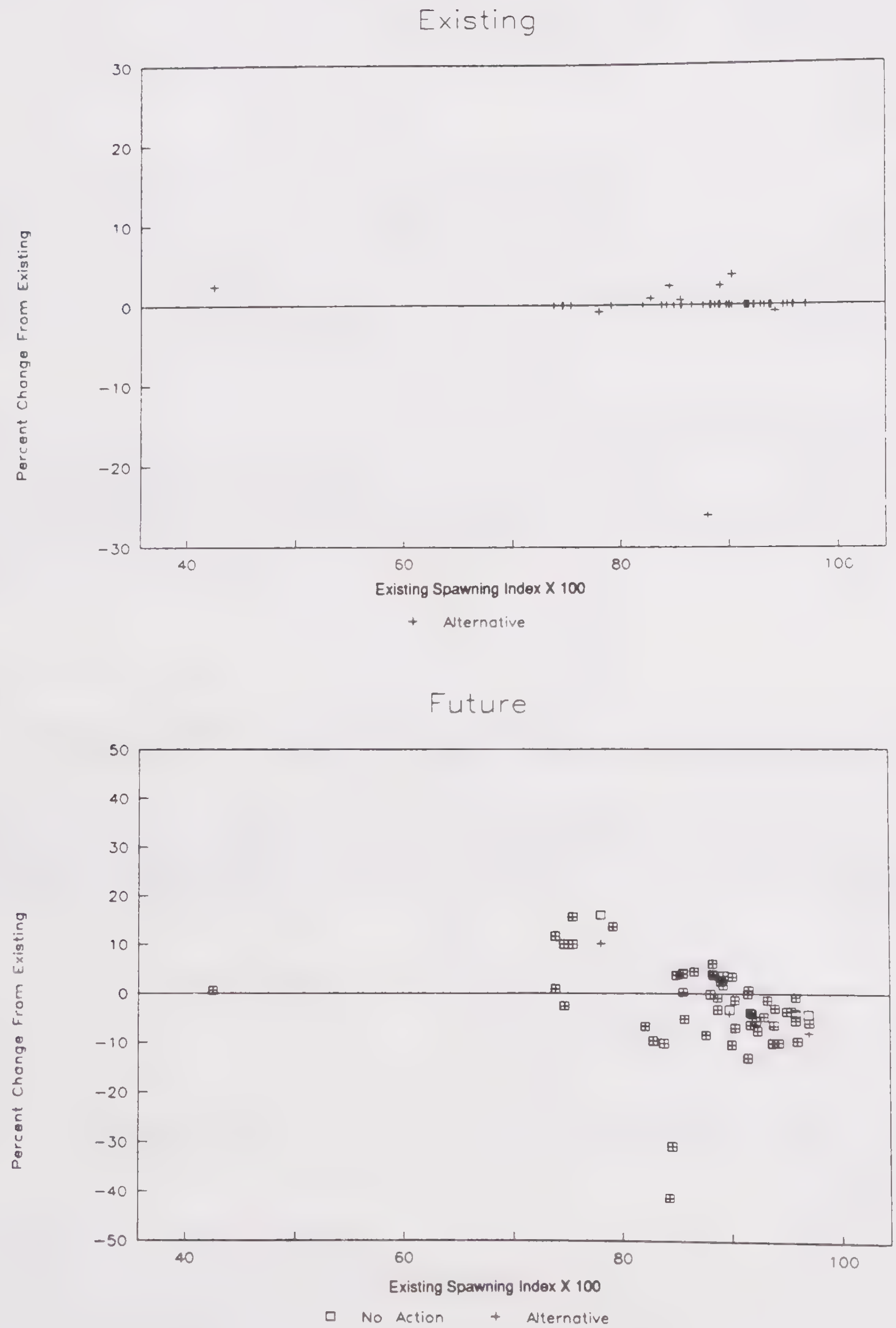


Figure 4-14. Change in Spawning Index for Chinook Salmon in the American River under Los Vaqueros Reservoir Alternative Operations

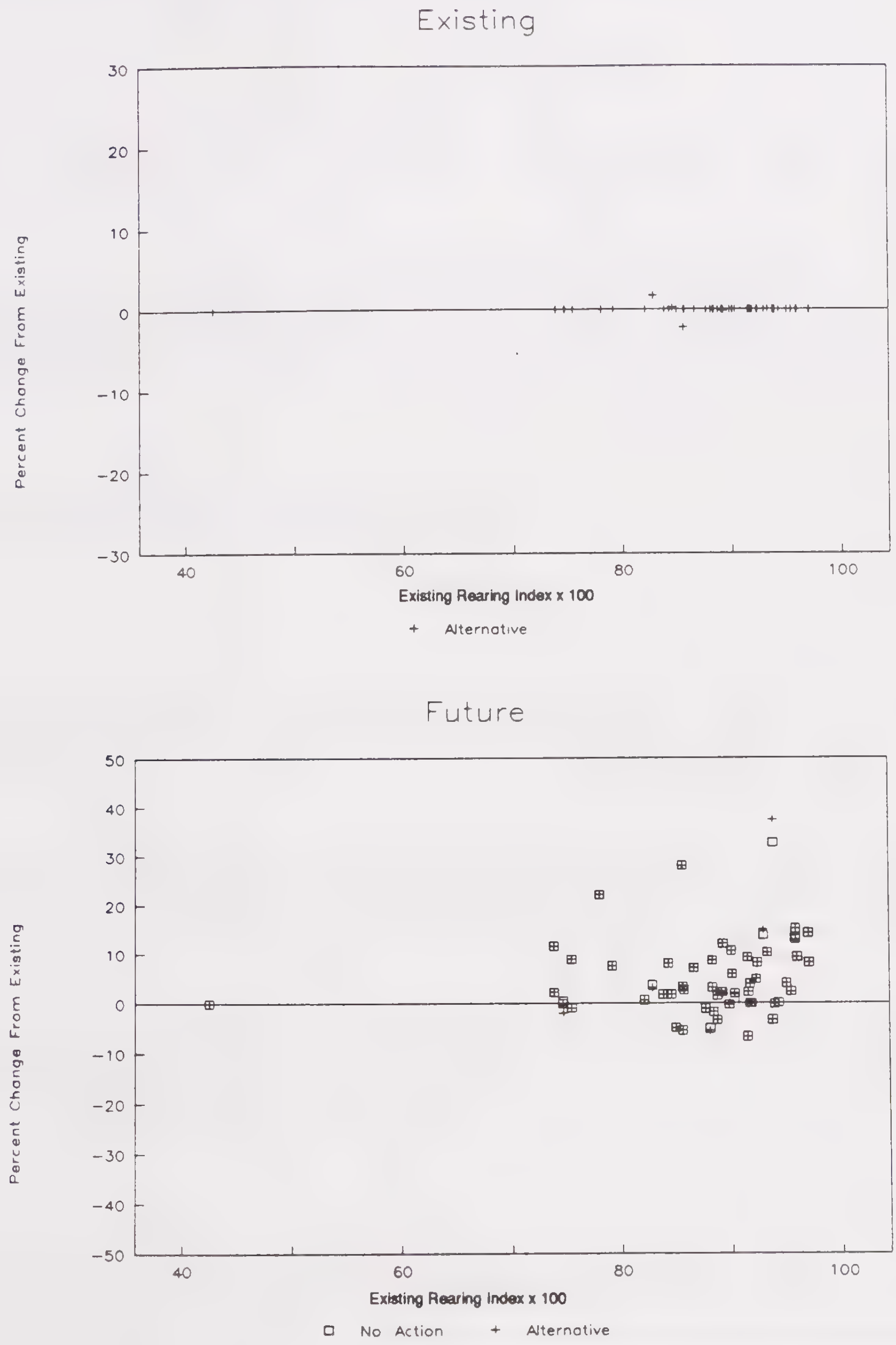


Figure 4-15. Change in the Rearing Index for Chinook Salmon in the American River under Los Vaqueros Reservoir Alternative Operations

Effects of Saline Discharge on Fish Survival

Between 5 and 25 mgd of saline water (3,526 mg/l TDS) would be discharged into Suisun Bay under this alternative. The discharge of brine would not affect fisheries because the discharge volume is small and its concentration is relatively low compared with water present in Suisun Bay.

Effects of Delta Cross Channel Diversions on Migration and Survival

The net change from existing conditions in the proportion diverted would be less than 1%, and fisheries resources would not be affected.

Chinook Salmon Mortality Index

Existing Conditions with Alternative. The index indicates that fishery resources would not be affected by the change in flow diverted through the Delta Cross Channel and Georgiana Slough. Mortality is nearly the same under existing and Desalination/EBMUD Emergency Supply Alternative conditions (Figure 4-16). A slight increase (less than 0.1%) would be attributable to increased CCWD diversion. This impact would be less than significant.

Future Conditions with Alternative. The Desalination/EBMUD Emergency Supply Alternative would not increase the number of outmigrant chinook salmon juveniles entering the central Delta and would therefore have no project-related impacts and would not contribute to any cumulative impacts.

Lower San Joaquin River Flow Effects on Migration and Survival

The frequency of reverse flow would be the same under existing conditions for the Desalination/EBMUD Emergency Supply and existing and No-Action Alternative conditions. Net lower San Joaquin River outflow would be lower during all months and the change from existing conditions and the No-Action Alternative would be less than 1%.

Relative to existing No-Action Alternative conditions, the frequency of reversed flow in the lower San Joaquin River increases during November-January, March, and June-September for future operations under both the Desalination/EBMUD Emergency Supply and No-Action Alternatives. Net lower San Joaquin River outflow would decrease during November-March and May-September. (See the same section under "No-Action Alternative".)

Future operations under this alternative would not change the frequency of reversed flow relative to future operations under the No-Action Alternative. Net lower San Joaquin River outflow, however, would decline under Desalination/EBMUD Emergency Supply Alternative future operations, similar to the difference between desalination and No-Action Alternative operations under existing conditions.

Striped Bass and the Striped Bass Survival Index

Existing Conditions with Alternative. Operations of this alternative under existing conditions would slightly reduce San Joaquin River outflow during April-June of most years and would retain additional striped bass in the central Delta where survival is reduced. Operations under this alternative would slightly reduce the striped bass abundance index relative to existing conditions (Figure 4-17). This slight impact would be less than significant, however, because it would not result in a measurable effect on the striped bass population.

Future Conditions with Alternative. As under existing conditions, Desalination/EBMUD Emergency Supply Alternative operations would cause a slight reduction in the striped bass abundance

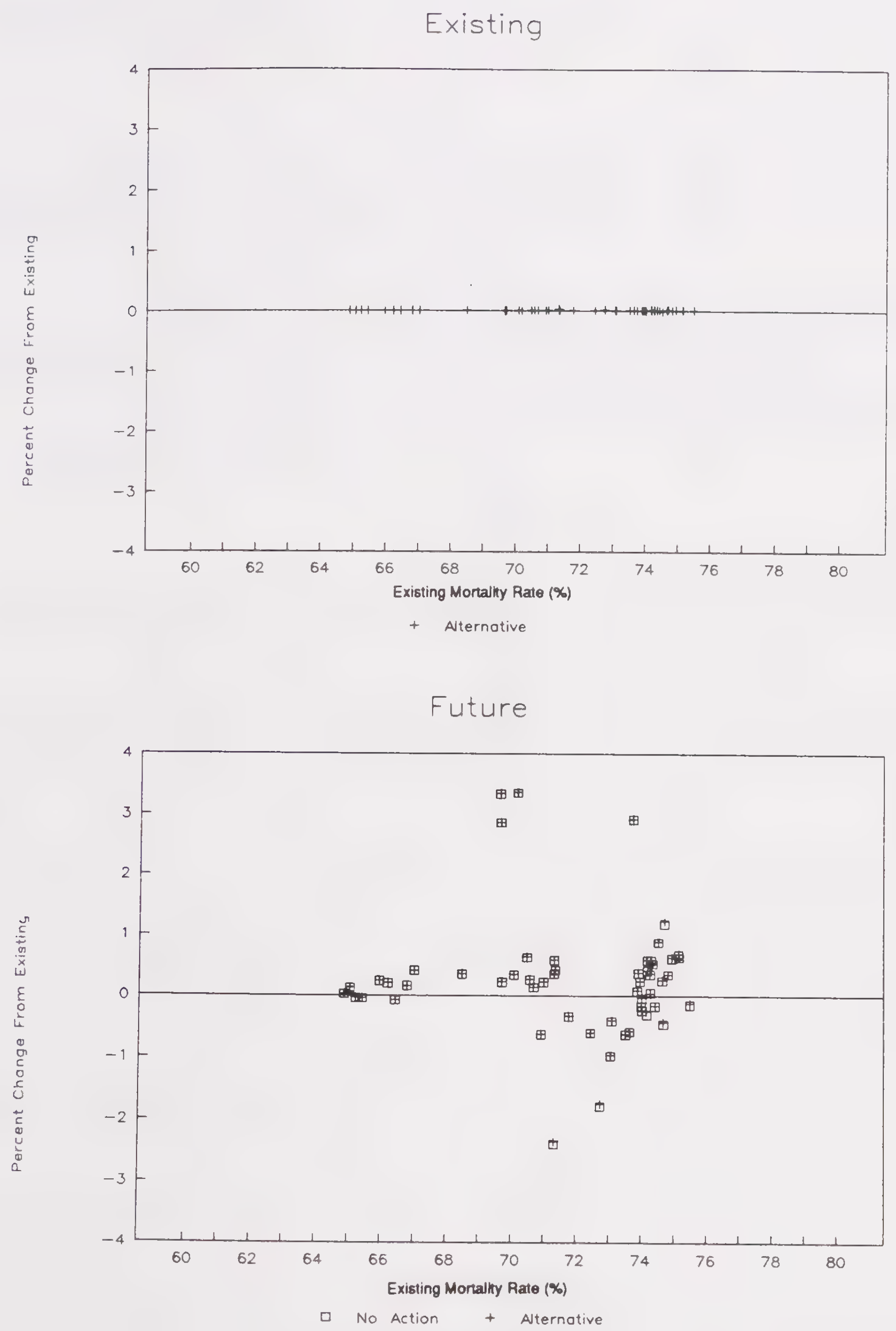


Figure 4-16. Change in Juvenile Chinook Salmon Mortality Rate under Desalination/ EBMUD Emergency Supply Alternative Operations

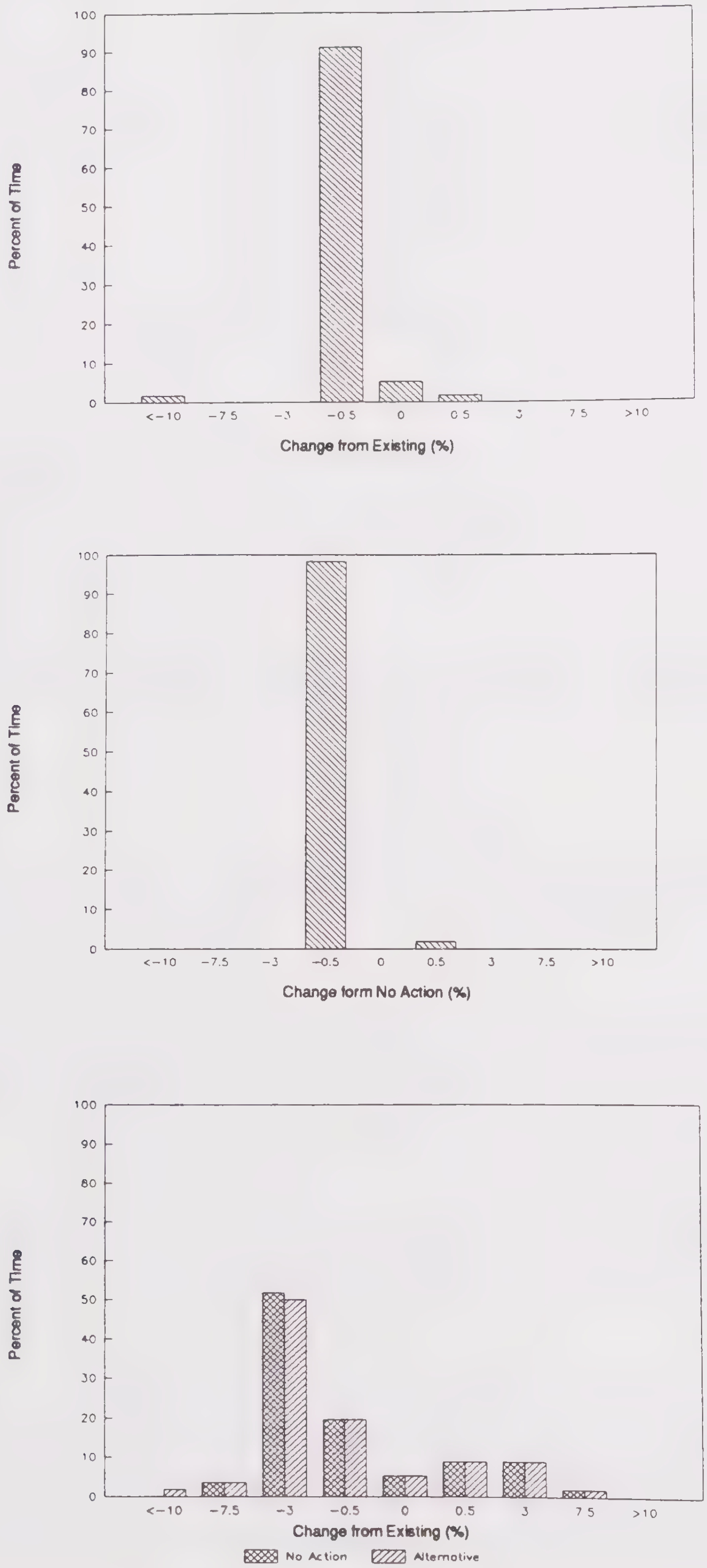


Figure 4-17. Change in Striped Bass Abundance Index under Desalination/ EBMUD Emergency Supply Alternative Operations

index compared to the No-Action Alternative. This project-related impact would be less than significant for the reasons described above under "Existing Conditions".

The Desalination/EBMUD Emergency Supply Alternative would, however, contribute slightly to significant Delta-wide comulative impacts.

Delta Smelt

Existing Conditions with Alternative. Operations under this alternative would result in minor reductions in net Delta outflow during April-July, and could retain additional Delta smelt in the central Delta where survival rates are lower. This impact would be less than significant because it would not result in a measurable impact on the Delta smelt population.

Future Conditions with Alternative. As under existing conditions, this alternative would result in only minor impacts on net Delta outflow compared to the No-Action Alternative. This impact would be less than significant for the reasons described above under "Existing Conditions".

The Desalination/EBMUD Emergency Supply Alternative would, however, contribute slightly to significant Delta-wide impacts on Delta smelt survival.

Losses to Entrainment

Operations under this alternative would increase the total monthly CCWD diversion by as much as 20% relative to diversion under the No-Action Alternative.

Fish Screen Design. Fish screen designs under this configuration would be similar to those described above under the Rock Slough/Old River configurations. Fish screens at a Rock Slough intake, however, would be less efficient than screens on Old River because of predation and the need to salvage screened fish.

Chinook Salmon

Existing Conditions with Alternative. Losses to entrainment of outmigrant chinook salmon juveniles under this alternative would decrease compared to No-Action Alternative conditions because the change in CCWD diversions would be slight and the new diversion would be screened (Figure 4-18). This impact would be less than significant.

Future Conditions with Alternative. As under existing conditions, operations under this alternative would result in small decreases in entrainment compared to the No-Action Alternative. This impact would be less than significant.

Winter-Run Chinook Salmon. Reduced entrainment of winter-run chinook salmon under both existing and future conditions would have a less-than-significant effect on juvenile abundance (Figure 4-18).

Striped Bass. Entrainment loss of striped bass greater than 38 mm would be similar to those described above for chinook salmon (Figure 4-18). Entrainment loss of striped bass less than 38 mm would increase under existing and future conditions. The effect of increased entrainment would not measurably affect striped bass populations; however, increased entrainment would contribute slightly to significant cumulative impacts of Delta-wide entrainment losses.

Delta Smelt. Impacts on Delta smelt would be similar to those described above for striped bass less than 38 mm.

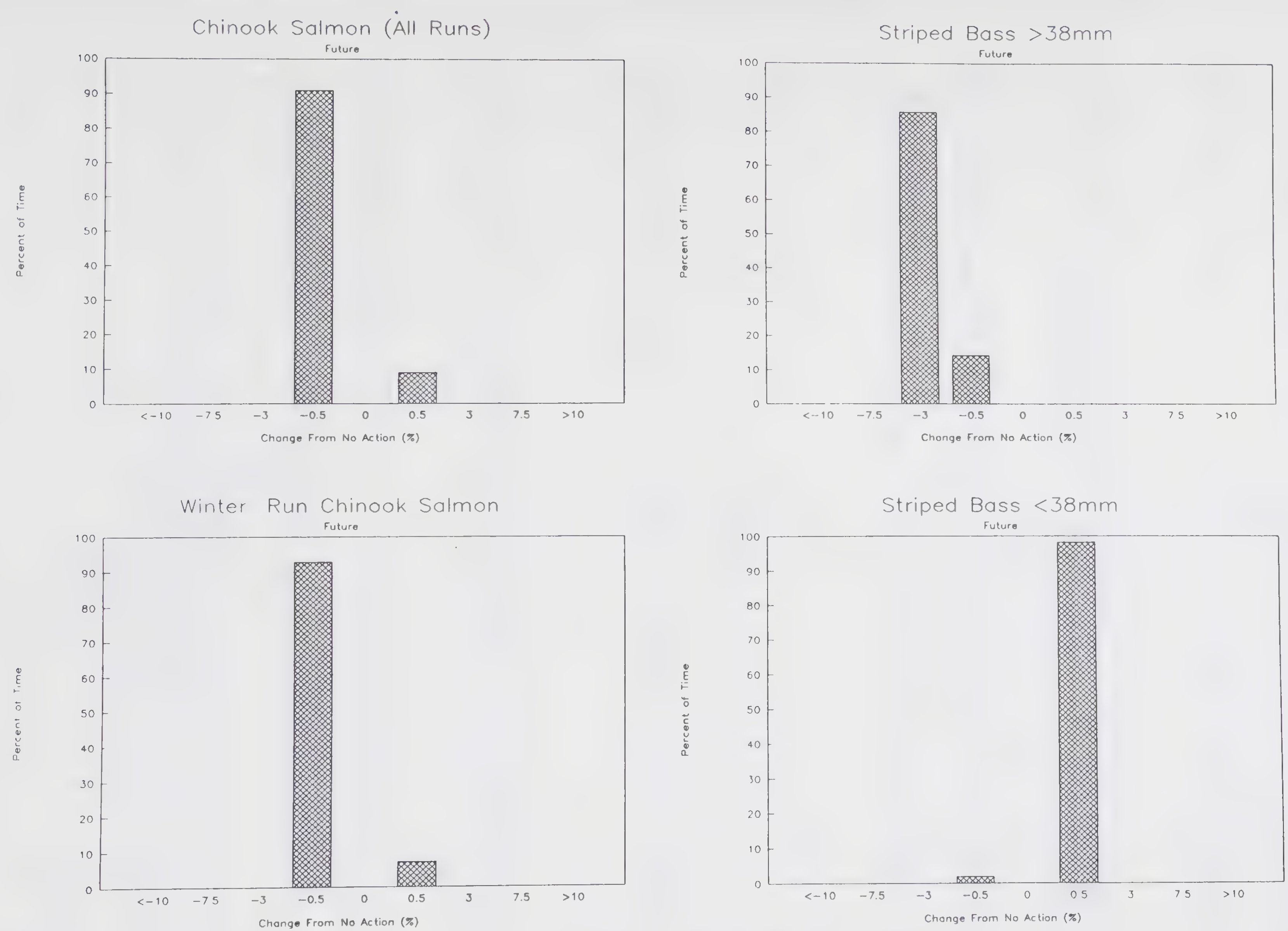


Figure 4-18. Change in Entrainment Loss of Chinook Salmon (All Runs), Winter-Run Chinook Salmon, and Striped Bass under Desalination Alternative Operations, under Future Conditions

American Shad

Existing and Future Conditions with Alternative. American shad are most susceptible to entrainment in Delta diversions during July-August and October-December. Increased American shad entrainment would occur during the entire period of susceptibility.

American shad abundance does not appear to be declining because of existing entrainment levels. Juvenile abundance in the Delta during fall is strongly correlated with high riverflow during spring (April-June), indicating that upstream factors may be controlling population abundance. Increased diversion loss under this alternative would therefore have a less-than-significant impact on the American shad populations.

Delta Outflow Effects on Migration and Habitat Quality in the Bay

The median reduction in monthly outflow attributable to the Desalination/EBMUD Emergency Supply Alternative would be less than 1% compared to both existing conditions and the No-Action Alternative. The change in outflow attributable to this alternative would have little effect on organisms in the Bay. Given existing information, impacts on Bay species would be less than significant. (See the same section under "No-Action Alternative").

Flow Effects on Habitat Availability and Migration in Rivers

Flow in the Trinity River would not change under this alternative. Flow in the Sacramento and American Rivers would change, but the changes would be small.

Sacramento River. The frequency of flows less than 6,000 cfs would be the same for operations under the Desalination/EBMUD Emergency Supply Alternative as compared to existing conditions and the No-Action Alternative. Chinook salmon in the Sacramento River would not be affected by flow changes attributable to this alternative. No impacts would result.

American River. In the American River, spawning and rearing indices are identical for flow under both existing and future operations of the Desalination/EBMUD Emergency Supply Alternative and existing conditions and the No-Action Alternative. No impacts would result.

Temperature Suitability in Rivers

As discussed above, this alternative would have no effect on flow in the Trinity River, and little effect on flow in the American or Sacramento Rivers. Compared to the No-Action Alternative, reservoir storage under the Desalination/EBMUD Emergency Supply Alternative would be slightly lower at Shasta, Folsom, and Clair Engle Reservoirs during most years.

Sacramento River. The frequency of storage in Shasta Reservoir of less than 2 million af under this alternative would be identical to the No-Action Alternative. However, Shasta Reservoir storage would be lower under this alternative (2-4% lower in drier years [Figure 4-19]). This decrease in storage volume would not result in measurable temperature effects in the Sacramento River and would be a less-than-significant impact.

Lower Shasta Reservoir storage would, however, contribute to significant cumulative impacts identified under the No-Action Alternative.

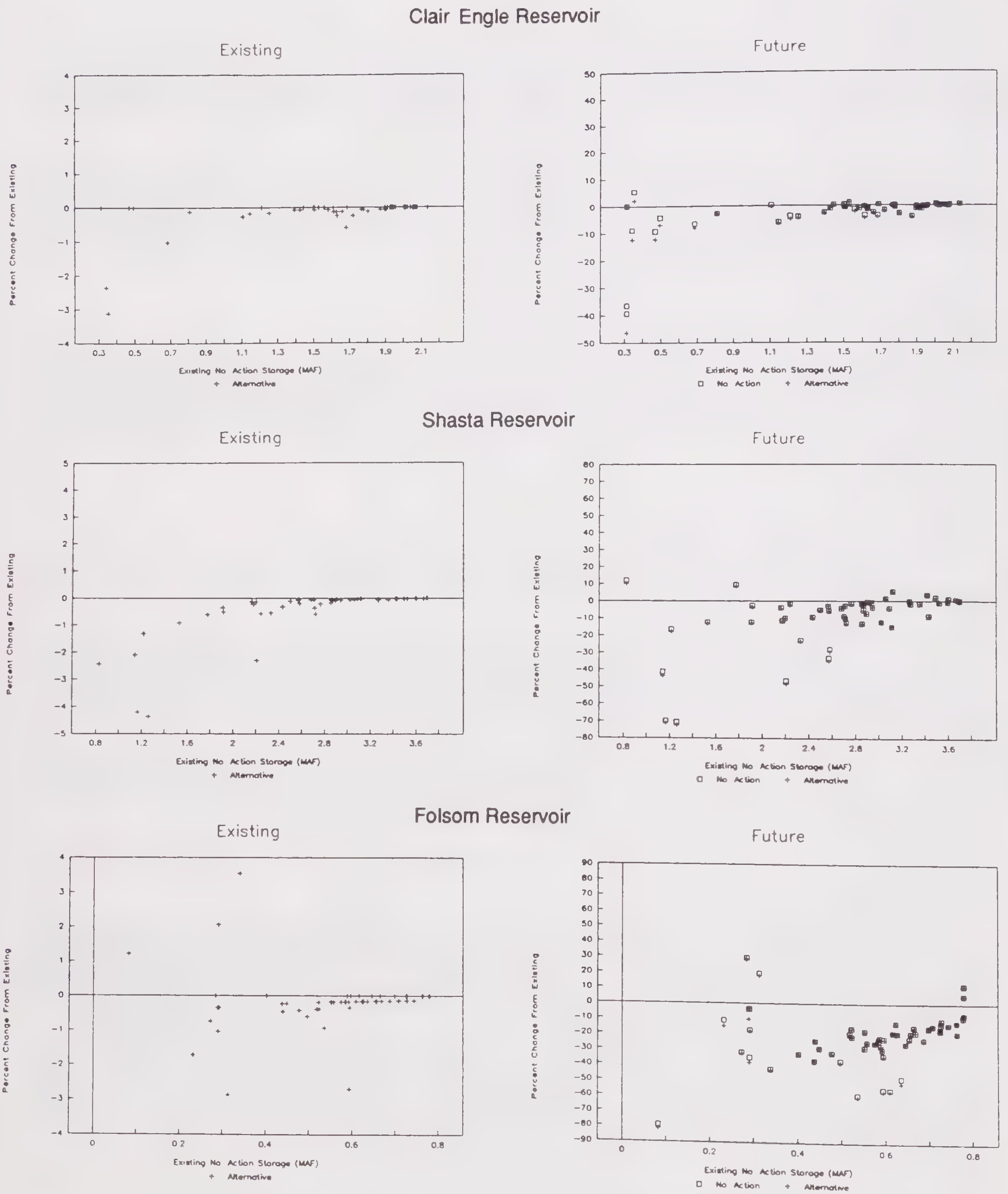


Figure 4-19. Change in CVP Reservoir Storage under Desalination/EBMUD Emergency Supply Alternative Operations

American River. Decreased storage in Folsom Reservoir (1-3% lower during drier years) under this alternative compared to the No-Action Alternative could result in slight unmeasurable temperature increases in the lower American River and would have a less-than-significant impact.

Lower Folsom Reservoir storage would, however, contribute to significant cumulative impacts identified under the No-Action Alternative.

Operations Effects on Fish Productivity in Reservoirs. The magnitude and frequency of declining water levels under this alternative would be essentially identical to those under existing conditions and the No-Action Alternative in Clair Engle, Shasta, and Folsom Reservoirs. No impacts would result.

Middle River Intake/EBMUD Emergency Supply Alternative

Intake Facility Construction on Middle River

Effects of Intake Construction on Fish Survival. Adverse effects would be the same as described above in the "Los Vaqueros Reservoir Alternative" section.

Effects of Structural Changes at the Intake Facility Site on Fish Habitat. Adverse effects would be the same as described above in the "Los Vaqueros Reservoir Alternative" section.

Effects of Structural Changes at the Pipeline Crossing of Old River on Fish Habitat. Structural changes to the levees and banks at the pipeline crossing of Old River between Woodward Island and Orwood Tract could have significant adverse impacts on local populations of resident species, such as catfish and largemouth bass. These impacts would be locally significant.

Delta

Generally, operations under this alternative would be the same as those described under existing conditions and the No-Action Alternative. Delta flow conditions and diversions would not change and effects on fisheries (attributable to operations) would be the same. Refer to the "Affected Environment" and "No-Action Alternative" sections above for a description of impacts.

The new supplemental intake on Middle River would be screened and would provide some benefits relative to diversions via the unscreened intake at Rock Slough. The screen design would be the same as that described for the new supplemental intake under the Los Vaqueros Reservoir Alternative (Appendix A).

Compared to existing conditions and the No-Action Alternative, screening a portion of CCWD's diversion under this alternative would reduce entrainment loss of chinook salmon and striped bass (Figure 4-20). This impact would be beneficial.

Affected Areas of the CVP

Upstream conditions would be the same as those described under the No-Action Alternative. Refer to the "No-Action Alternative" section above for a description of impacts and their significance.

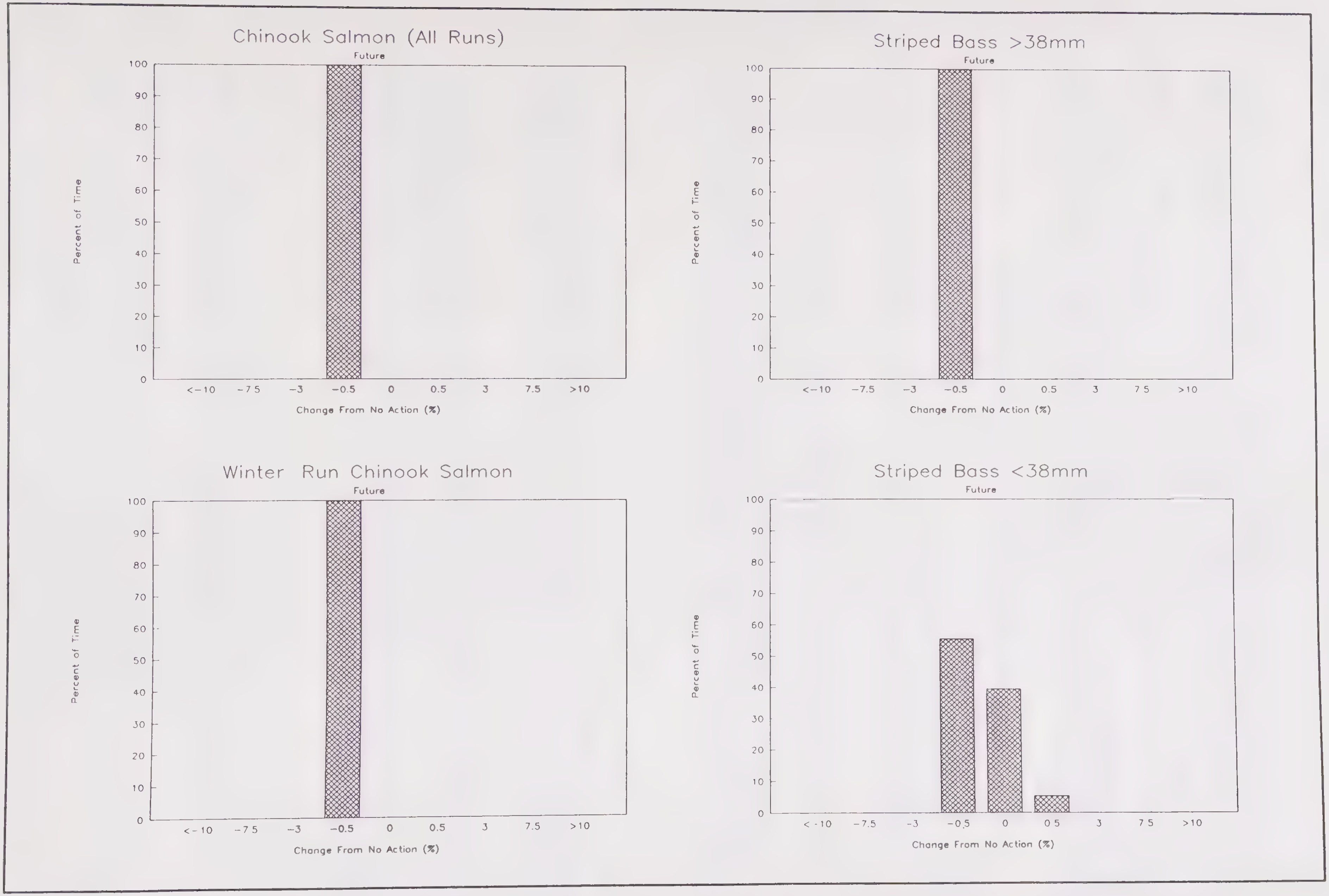


Figure 4-20. Change in Entrainment Losses under Middle River Intake/EBMUD Emergency Supply Operations under Future Conditions

CUMULATIVE FUTURE IMPACT ANALYSIS

The analysis presented below includes CCWD buildout demands of 174,600-188,000 af/yr, assuming that none of the project alternatives described in this EIR/EIS are developed. Based on modeling conducted for existing and future conditions, and the proportion of CCWD diversions to total diversions under cumulative future conditions, changes in diversions related to the project alternatives would have an imperceptible effect on Delta hydrology and fisheries. Therefore, fisheries impact analyses for cumulative future conditions that include diversions by CCWD of its buildout water demands on its existing diversion pattern are considered to reflect cumulative impact conditions with the project alternatives.

Methods

The cumulative impact analysis for fisheries resources is qualitative and is based on hydrologic simulations from DWRSIM. The cumulative impact analysis model uses future demands and assumes that the following proposed projects are implemented: North Delta Water Management Program, South Delta Water Management Program, Los Banos Grandes Reservoir, Kern Water Bank, Delta Wetlands Project, and expanded Harvey O. Banks pump capacity. DWRSIM does not simulate the Delta water programs but assumes that additional water can flow through the Delta. Physical changes to the Delta environment include increased capacity of the Delta Cross Channel and Mokelumne River channels to transfer additional water across the Delta and closure of Old River at its confluence with the San Joaquin River near Mossdale (California Department of Water Resources 1990a, 1990b).

Impact assessment also considers existing fisheries information, impacts identified under existing and future conditions in this EIR/EIS, and effects on fisheries identified in the environmental documents completed for other proposed projects (California Department of Water Resources 1990a, 1990b).

Cumulative Future Impact Analyses

Effects of Delta Cross Channel Diversions on Fish Migration and Survival

Without changes in existing operations criteria or establishment of physical barriers, additional Sacramento River fish would move into the Central Delta through the enlarged Delta Cross Channel under cumulative future conditions.

In addition, increased frequency of reduced Delta inflow during May-June relative to existing conditions (Figure 4-21) could result in diversion of proportionately more Sacramento River water into the Delta Cross Channel and Georgiana Slough. Transfer of a greater proportion of Sacramento River water through the Delta Cross Channel and Georgiana Slough during May-June would draw more chinook salmon and striped bass from the Sacramento River into the central Delta where survival rates would be reduced relative to survival rates for fish continuing down the Sacramento River. This impact would be significant.

Delta Flow Effects on Migration and Survival

Reverse flows in the lower San Joaquin River are expected to be less frequent under cumulative future conditions than under existing and future conditions (California Department of Water Resources 1990a, 1990b). Also, net lower San Joaquin outflow would be higher.

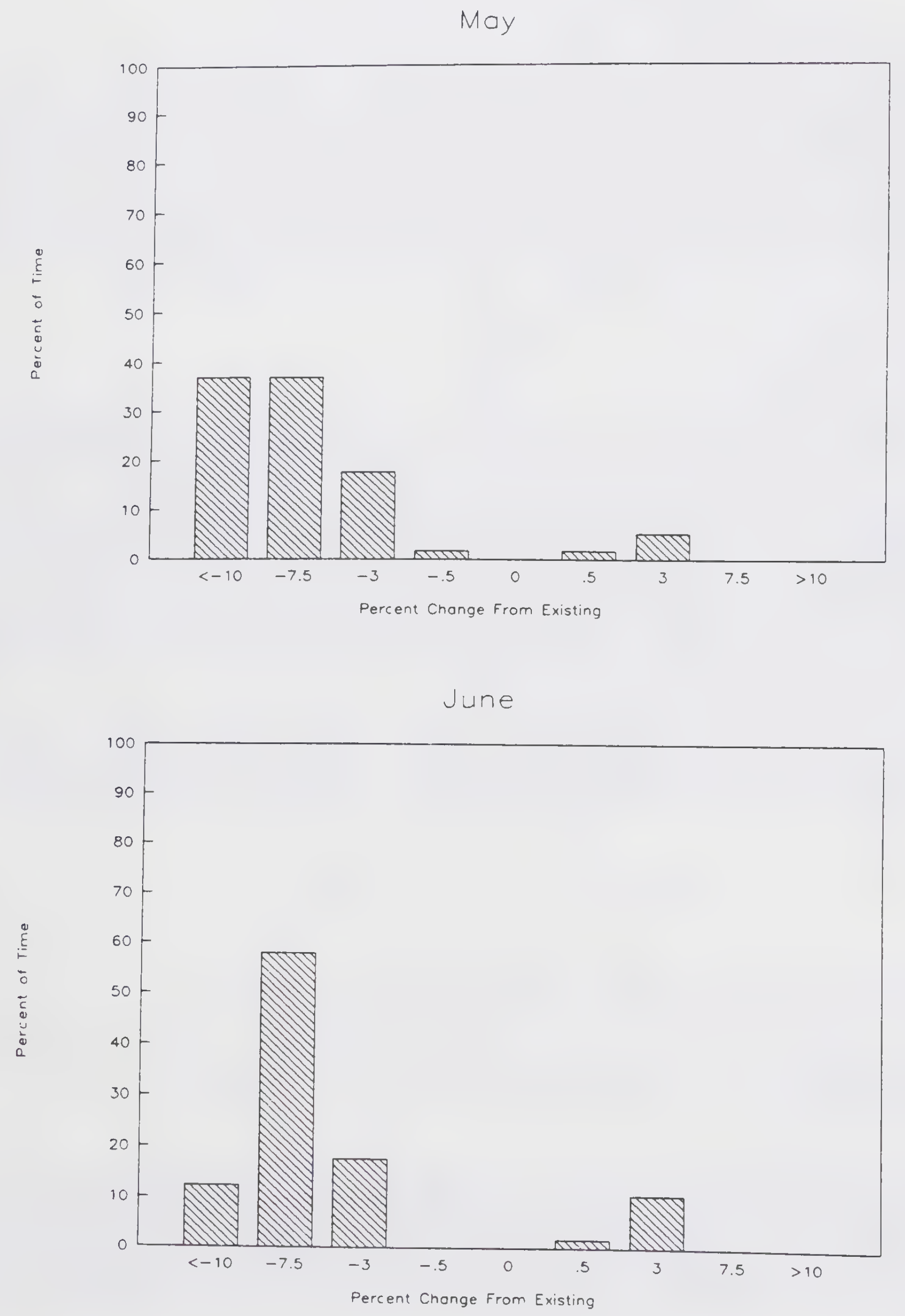


Figure 4-21. Change in Delta Inflow under Cumulative Future Conditions

Diversion from the Delta would increase, but the proposed enlargement of the Delta Cross Channel and Mokelumne River channels would allow more Sacramento River water to be transferred into the central Delta via the Delta Cross Channel and Mokelumne River rather than through Threemile Slough and the lower San Joaquin River.

As under existing conditions, flow patterns in the Delta would have significant adverse impacts on chinook salmon juveniles, Delta smelt larvae and juveniles, and striped bass eggs and larvae. Increased lower San Joaquin River outflow, however, would likely increase survival of juvenile chinook salmon migrating out of the Delta via the San Joaquin River and transport more striped bass and Delta smelt toward Suisun Bay where survival would be greater than in the Delta. Juvenile salmon originating in the Sacramento, Mokelumne, and San Joaquin Rivers would benefit from increased lower San Joaquin River outflow. Juvenile chinook salmon from the San Joaquin River would benefit from closure of Old River near Mossdale proposed by DWR in the South Delta Water Management Plan.

Losses to Entrainment in Export

Diversions would increase from existing levels under cumulative future conditions during August-April of most years. Diversion would decrease during May-July (Figure 4-22).

Although export would increase during April, annual entrainment of chinook salmon (fall run), striped bass, and Delta smelt might be lower under cumulative future conditions than under existing conditions. During April, juvenile chinook salmon and larval striped bass and Delta smelt are more likely to occur in the lower San Joaquin River during drier years than during wetter years. Under cumulative future conditions, export during April would increase only during wet and above-normal years and not during dry and below-normal years. Delta export would likely continue to have a significant cumulative adverse impact on chinook salmon, Delta smelt, and striped bass populations, however.

Entrainment of winter-run chinook salmon and American shad would likely increase because of increased export during peak migration periods. Winter-run would be most affected by increased export during March and shad would be most affected by increased export during October-December. Increased entrainment would have significant adverse impacts on winter-run chinook salmon.

Delta Outflow Effects on Migration and Habitat Quality in the Bay

Under cumulative future conditions, Delta outflow would be reduced during every month relative to existing conditions. As under the No-Action Alternative, outflow reductions during January-May would probably have the most detrimental effect on Bay species. The effect of reduced outflow would be the same as described for the No-Action Alternative; however, the reduction in outflow would be greater.

Flow Effects on Habitat Availability and Migration in Rivers

Under cumulative future conditions, flow in the Trinity River would not change from that simulated for existing conditions. Flow in the Sacramento and American Rivers would be affected.

Sacramento River flow would increase during September, October, and February and decrease during April and July relative to existing conditions. During August, flows would be lower during wet years and higher during dry years. The effect of flow changes on fisheries would be similar to effects described under future No-Action Alternative conditions and would be less than significant.

Winter-, spring-, and fall-run chinook salmon would benefit from the increased occurrence of flows exceeding 6,000 cfs during September and October (Figure 4-23). Fall and late-fall runs would be adversely affected by the increased occurrence of flows less than 6,000 cfs during November-January and April.

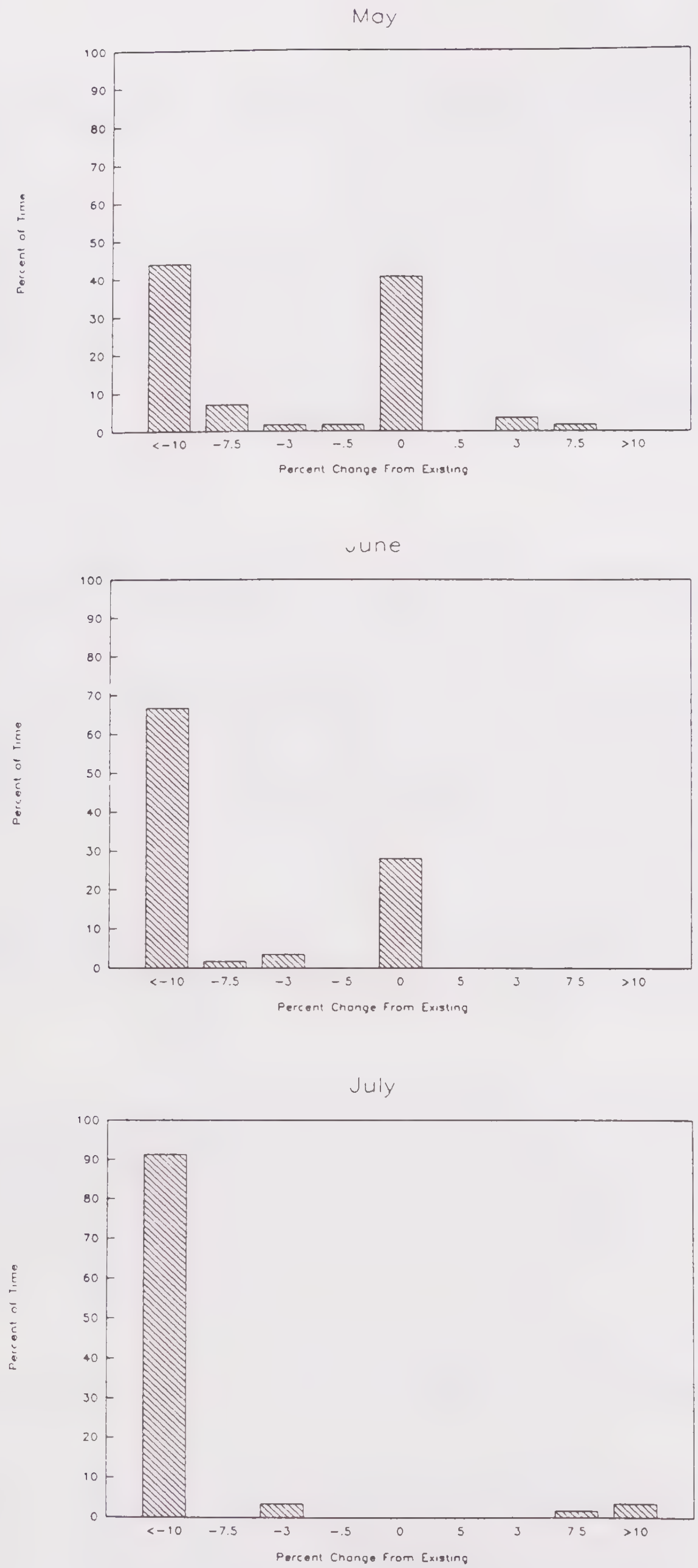


Figure 4-22. Change in Total CVP and SWP Export under Cumulative Future Conditions

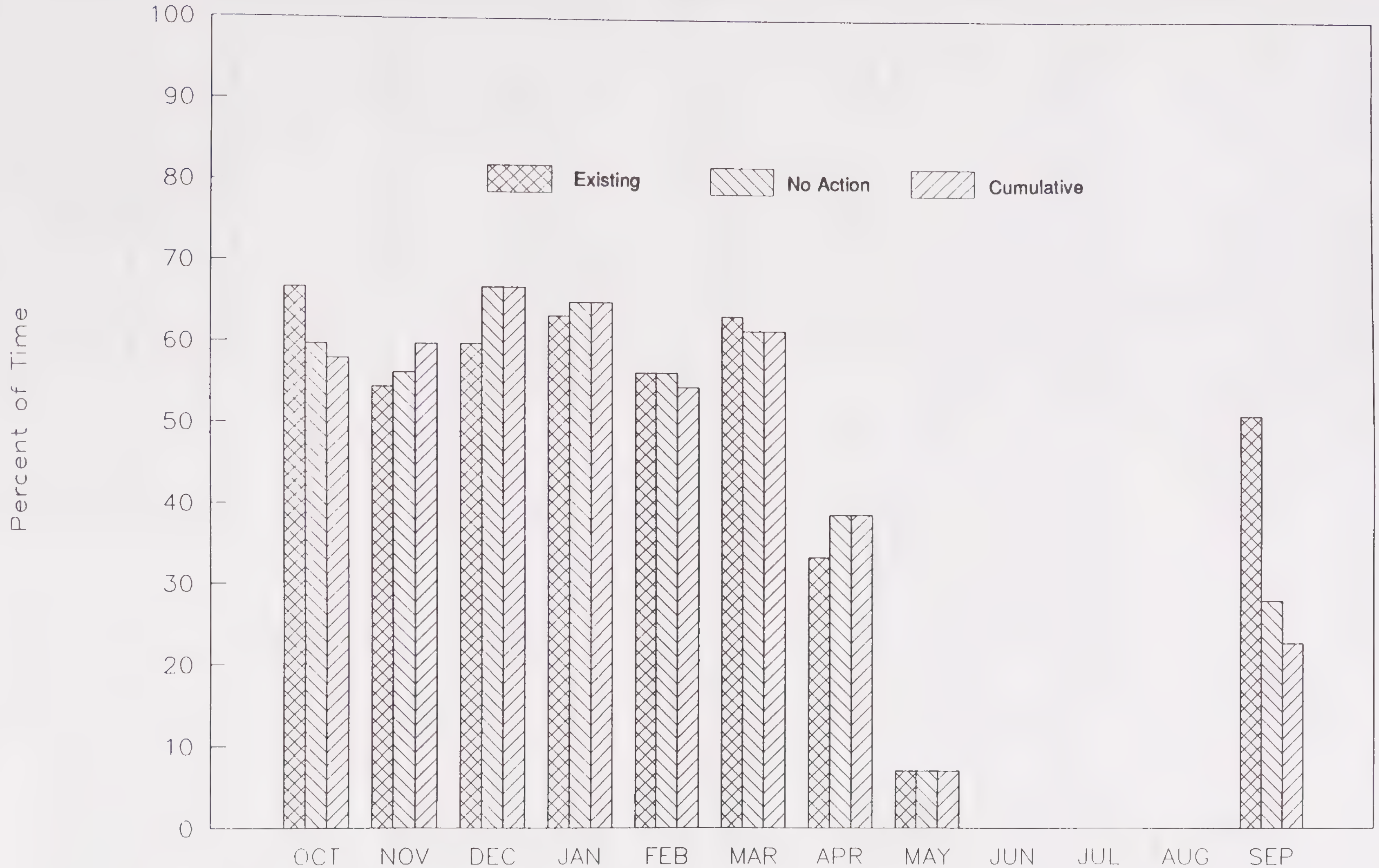


Figure 4-23. Percent of Time That Sacramento River Flow at Keswick Dam Would Be Less Than 6,000 cfs

Considering that flows less than 6,000 cfs already occur during at least 1 month during November-January over 80% of the time under existing conditions, the change in flow would have a less-than-significant adverse impact on fall-run chinook salmon. Effects on late fall-run chinook salmon also would be less-than-significant.

Flow in the American River under cumulative future conditions would be substantially less than flow under existing conditions. Effects on chinook salmon (e.g., spawning and rearing indices) would be the same as those described under the No-Action Alternative (Figure 4-10).

Temperature Suitability in Rivers

Flow in the Trinity River would be nearly the same as under existing conditions and would have little effect on temperature. Operations under cumulative future conditions would substantially affect reservoir levels that would already be low during 2-3 years (Figure 4-24); therefore, the adverse effects of increased temperature on chinook salmon and steelhead trout populations would be less than significant.

Water released from Shasta Reservoir influences Sacramento River temperature primarily during summer. Based on model simulations, summer releases decrease under cumulative future conditions during July and August. Effects of flow changes on temperature would likely be minimal because flow exceeds 10,000 cfs most of the time. Also, flow reductions generally occur with high flows while, under simulated conditions, low flows increase. Suitable discharge water temperature can usually be maintained if storage in Shasta Reservoir is greater than 2 million af during July-September. Reservoir storage under cumulative future conditions would be substantially lower than under existing conditions and the frequency of storage less than 2 million af would double (Figure 4-24).

The proposed outflow temperature control structure in Shasta Reservoir would enable access to cool water for discharge during periods of reduced reservoir storage. Reservoir storage volume, however, would continue to determine the availability of cool water, and operations under cumulative future conditions would increase the probability of warmer discharge temperatures. Increased temperature would have significant adverse impacts on winter-, spring-, and fall-run chinook salmon.

Warm temperatures in the American River adversely affect rearing success during May-June and spawning success during September-November. River water temperature could increase because of reduced flow during May-October. Folsom Reservoir storage would be substantially lower under cumulative future conditions than under existing conditions (Figure 4-24). Cool water is generally inaccessible for release to the river at reservoir levels below 300,000 af. Storage would reach levels less than 300,000 af twice as often under cumulative future operations.

Increased temperature resulting from lower reservoir storage and lower flows under cumulative future conditions could have significant adverse impacts on survival of chinook salmon spawning and rearing in the American River.

Operations Effects on Fish Productivity in Reservoirs

The relatively small change in Clair Engle Reservoir storage under cumulative future conditions would not affect fish productivity.

Shasta Reservoir storage would be substantially lower under cumulative future conditions (Figure 4-25). During the spawning and rearing period for bass, sunfish, and other reservoir species (March-August), the decline in water surface elevation would be nearly the same under existing and cumulative conditions, except when the decline in water surface elevation for both existing and cumulative conditions exceeds 25 feet (Figure 4-25). This impact of reduced storage and surface elevation changes would be less than significant.

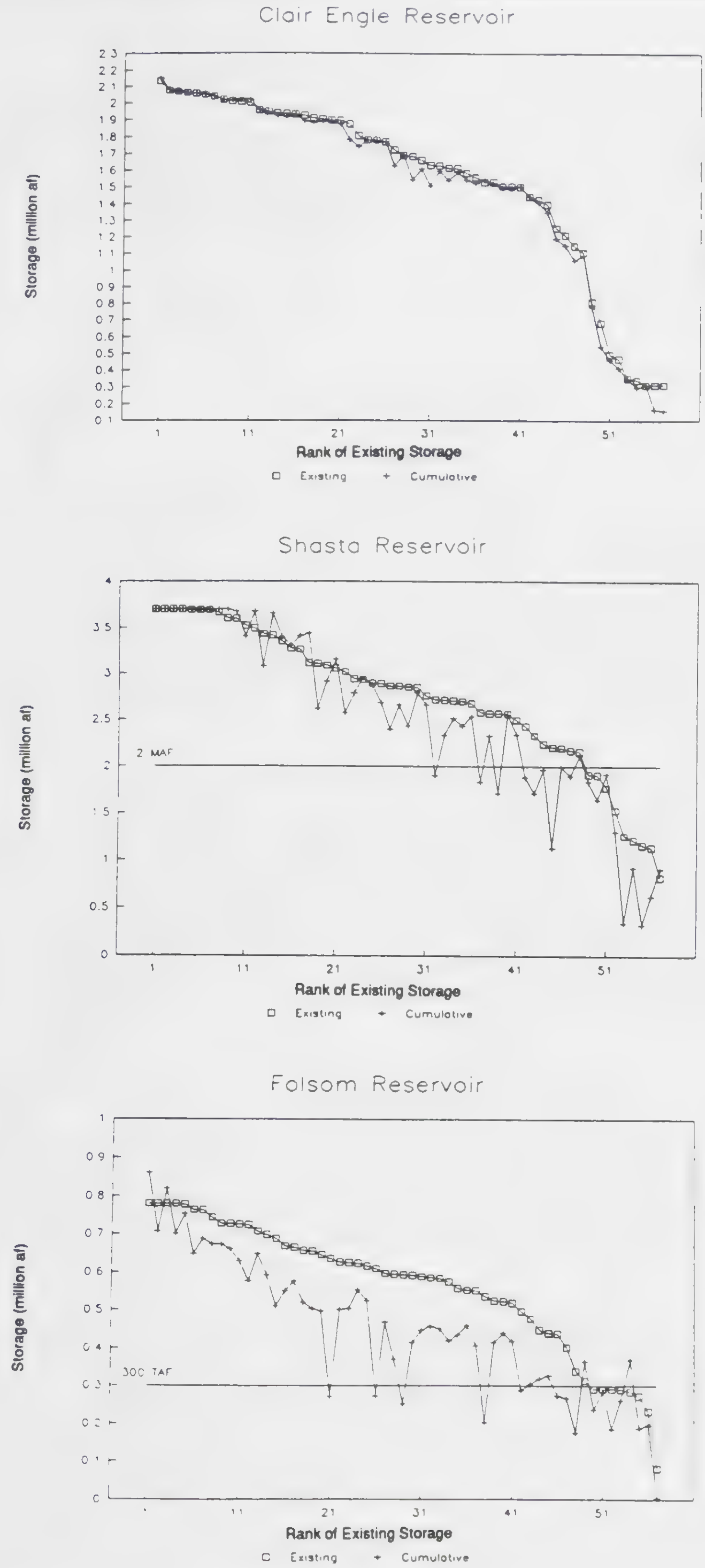
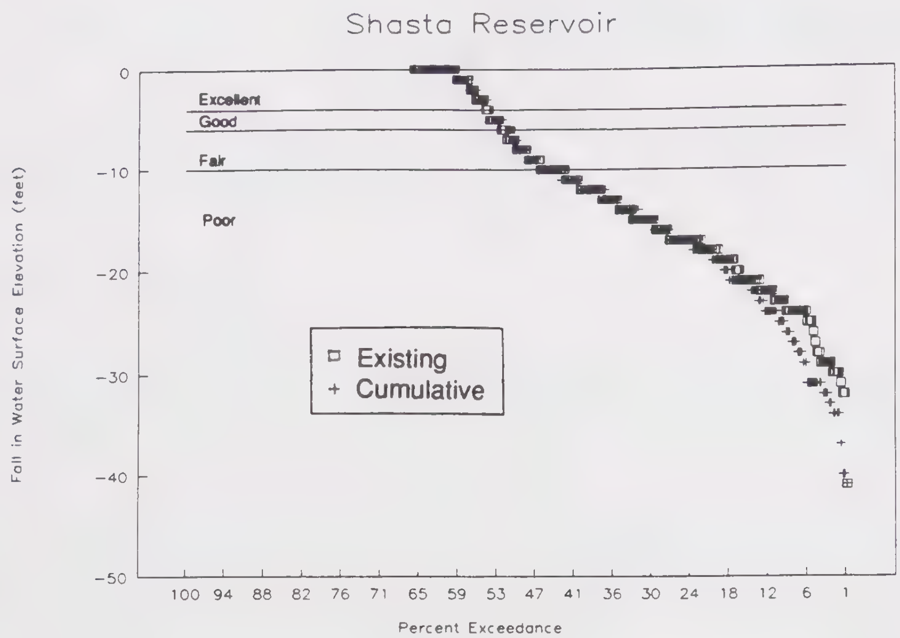


Figure 4-24. Reservoir Storage under Existing and Cumulative Future Conditions



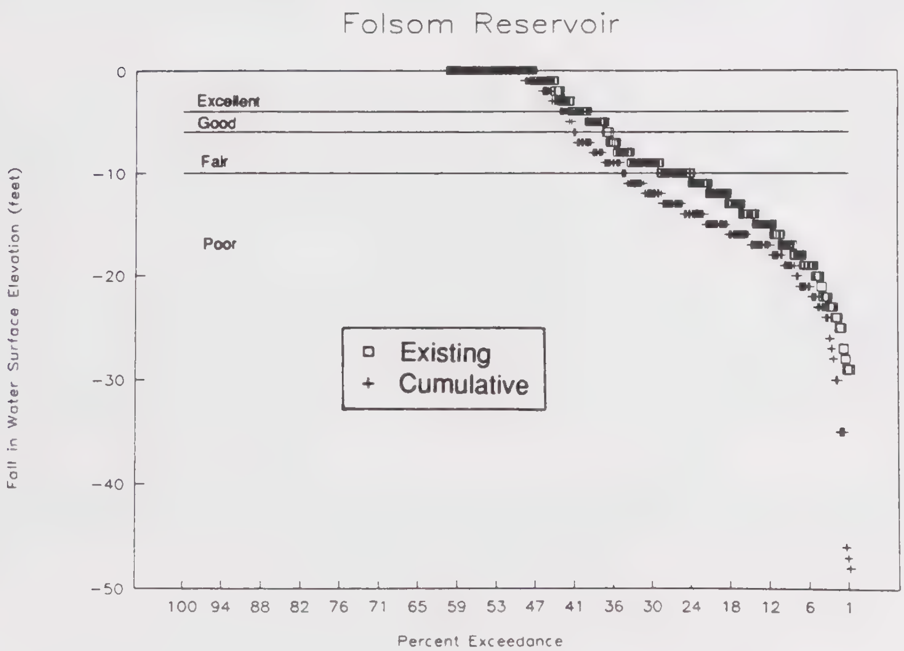


Figure 4-25. Comparison of Spawning and Rearing Success under Existing and Cumulative Future Conditions

Folsom Reservoir storage also would be substantially lower under cumulative future conditions (Figure 4-25). During the spawning and rearing period for bass, sunfish, and other reservoir species, the decline in water surface elevation would be greater under cumulative future conditions than under existing conditions and spawning and rearing success would be reduced (Figure 4-25). Considering the substantially lower reservoir level and the reduced spawning and rearing success, cumulative future operations could have a significant adverse impact on fish productivity in Folsom Reservoir.

MITIGATION MEASURES

No-Action Alternative

Reclamation is not proposing to implement measures described below. Neither the CVP nor the SWP are proposing to increase diversions from the Delta for the Los Vaqueros Project. The sole purpose of this mitigation measure discussion is to provide a clear distinction between those impacts and related mitigation measures that are a result of simulated changes in background conditions, and those impacts that are a direct result of implementing the project alternatives considered in this EIR/EIS. The following discussion of mitigation measures focuses on those measures that could reduce to less-than-significant levels impacts relating to potential increases in CVP, SWP, and other diversions that may occur over time, assuming that no new Delta water transfer facilities are constructed. These measures are unrelated to the Los Vaqueros Project.

Reclamation, along with DWR and other water users, is continually working with appropriate resource agencies, including DFG, NMFS, and USFWS, to establish programs to benefit fishery resources. Implementation of the measures described below would appropriately include participation by all water users that divert water from the Sacramento River and San Joaquin River systems and the Delta.

Some or all of these measures may not be appropriate if SWRCB and EPA establish new water quality standards in the Delta that result in increased Delta outflow, although such standards could substantially affect other resources.

Effects of Delta Cross Channel Diversions on Migration and Survival

Prevent Diversion of Outmigrating Juvenile Chinook Salmon from the Sacramento River into the Central Delta. Two structural and operational changes could each prevent juvenile chinook salmon from entering the central Delta. Participation of CVP and SWP contractors and other water districts and individuals that divert water from the Delta or the Mokelumne River and San Joaquin River systems would be appropriate for either of these measures.

Construct a Gate on Georgiana Slough. A gate similar to the Delta Cross Channel gate could be constructed on Georgiana Slough where it joins the Sacramento River. The Delta Cross Channel and Georgiana Slough gates could then be closed during periods of significant chinook salmon outmigration. Timing of gate closure could be based on historical migration patterns or on actual migration, which could be determined by intensive upstream sampling or hydroacoustic fish counters installed at the opening of the Delta Cross Channel and Georgiana Slough.

Gate closure could increase reverse-flow conditions in the central Delta and adversely affect other species, such as striped bass and Delta smelt. Mitigation discussed below for San Joaquin River chinook salmon and striped bass could be implemented to reduce these impacts.

Construct a New Delta Cross Channel Connection. Alternatively, the Delta Cross Channel and Georgiana Slough could be closed and a new Delta Cross Channel connection with fish screens could be constructed at a point upstream that would ensure efficient screening of the juvenile salmon.

Lower San Joaquin River Flow Effects on Migration and Survival

Increase San Joaquin River Inflow and Reduce Diversions to Minimize Impacts on Outmigrating Juvenile Chinook Salmon from the San Joaquin River. Upstream reservoirs, including New Melones, could make additional flow releases during peak chinook salmon outmigration. The CVP and SWP, along with other Delta water diverters could curtail pumping until the majority of migrants moved out of the lower San Joaquin River.

This measure, implemented in conjunction with the measure described above under "Prevent Diversion of Outmigrating Juvenile Chinook Salmon from the Sacramento River into the Central Delta", would also reduce impacts on striped bass and Delta smelt to less-than-significant levels.

Losses from Entrainment

Impacts from entrainment losses could be reduced to less-than-significant levels by implementing the measures discussed above, along with additional measures. Increased entrainment losses under the No-Action Alternative are largely caused from alterations to Delta flow patterns that draw or retain additional fish in the central and south Delta. Measures to reduce entrainment losses are discussed below by species.

Chinook Salmon

Sacramento River Chinook Salmon. Implementing the measure described above under "Prevent Diversion of Outmigrating Juvenile Chinook Salmon from the Sacramento River into the Central Delta" would reduce impacts to less-than-significant levels.

San Joaquin River Chinook Salmon. Closing Old River at its confluence with the San Joaquin River near Mossdale during the March-June outmigration period would reduce impacts to less-than-significant levels. The CVP, SWP, and other Delta water diverters could appropriately participate in implementing this measure.

Striped Bass. Implementing the measures described above under "Prevent Diversion of Outmigrating Juvenile Chinook Salmon from the Sacramento River into the Central Delta" and "Increase San Joaquin River Inflow and Reduce Diversions to Minimize Impacts on Outmigrating Juvenile Chinook Salmon from the San Joaquin River" would reduce impacts to less-than-significant levels.

Delta Smelt. Implementing the measures described above under "Prevent Diversion of Outmigrating Juvenile Chinook Salmon from the Sacramento River into the Central Delta" and "Increase San Joaquin River Inflow and Reduce Diversions to Minimize Impacts on Outmigrating Juvenile Chinook Salmon from the San Joaquin River" would reduce impacts to less-than-significant levels.

Temperature Suitability in Rivers

Maintain Suitable Temperatures in the Sacramento River. If constructed, the proposed Shasta Outflow Temperature Control Device could maintain adequate water temperatures at reduced reservoir elevations. Alternatively, Shasta Reservoir could be operated to maintain a minimum September storage greater than 2 million af, and sufficient flows could be released to maintain temperatures conducive to survival and normal development of chinook salmon eggs in the Sacramento River upstream of Bend Bridge.

Either of these measures would mitigate impacts to less-than-significant levels. Reclamation and CVP contractors could appropriately participate in the implementation of this measure.

Maintain Suitable Temperatures in the American River. Folsom Reservoir could be operated to maintain a minimum September storage to provide sufficient flows with temperatures conducive to survival and development of chinook salmon eggs and juveniles in the area within about 7 miles below Nimbus Dam. The minimum storage and necessary flow would need to be developed in consultation with DFG and USFWS. Reclamation and upstream water users could make structural or operational modifications in the dam that would enable water to be released from deeper portions of the reservoir during periods when increased temperatures could adversely affect chinook salmon. Implementation of this measure would reduce impacts to less-than-significant levels. Reclamation and CVP contractors could appropriately participate in the implementation of this measure.

Operations Effects on Fish Productivity in Reservoirs

Folsom Reservoir. Enhancing fisheries in reservoirs with severely fluctuating water levels is largely untested. Enhancement techniques could include stocking juveniles of affected species and constructing habitat at several reservoir elevations over extensive areas. Operating the reservoir to maintain stable water levels through the spawning and rearing period could also increase fish productivity. Implementation of this measure would reduce impacts to less-than-significant levels. Reclamation and CVP contractors could appropriately participate in the implementation of this measure.

Los Vaqueros Reservoir Alternative

The following measures could be implemented to reduce impacts attributable specifically to the Los Vaqueros Reservoir Alternative to less-than-significant levels. Implementing these measures would be the sole responsibility of CCWD.

Intake Facility Construction

4-1: Prevent Increased Levels of Suspended Sediments. Increased sediment input could have a significant adverse impact on fish in habitats adjacent to the construction site.

To reduce these impacts to less-than-significant levels, measures including floating silt curtains, silt fences, and stormwater detention during construction could be implemented to ensure that any construction effects are highly localized.

4-2: Restore Fisheries Habitat at the Intake Facility Site. Structural changes at the intake site could have significant adverse impacts on local populations of resident species.

Affected habitat could be mapped and categorized before construction. Constructing intake facilities in habitats with existing riparian and aquatic vegetation could be avoided if possible. If modifying existing habitat with riparian and aquatic habitat is unavoidable, riparian and aquatic vegetation would be reestablished on the newly constructed levees or on levees currently lacking the structural variability of riparian and aquatic vegetation. Location and extent of habitat restoration activities would be determined in consultation with DFG.

Delta-Related Impacts

No significant direct impacts relating to the operation of the Los Vaqueros Reservoir Alternative were identified. Under future conditions, however, this alternative was found to contribute slightly to significant cumulative impacts identified under the No-Action Alternative. Mitigation measures described for the No-Action Alternative would reduce these significant cumulative impacts to less-than-significant levels. As a CVP contractor and Delta diverter, CCWD could participate in implementation of those measures. CCWD's financial participation could be proportional to the amount of water diverted from the Delta annually. However, funding and accounting mechanisms for these programs have not been developed and would generally be the responsibility of SWRCB, DWR, and Reclamation.

There are no feasible measures that can be incorporated into the Los Vaqueros Reservoir Alternative that could substantially reduce those cumulative impacts because, under any scenario, CCWD diversions are only a very small proportion of total Delta diversions. The mitigation measures discussed below focus, on reducing or eliminating CCWD's contribution to those Delta-wide cumulative impacts.

Cumulative Effects of Delta Cross Channel Diversions on Migration and Survival

4-3: Contribute to Ongoing Fishery Mitigation Programs. Conditions in the central Delta are slightly worsened by increased CCWD diversions in some months under this alternative. Altering CCWD's proposed diversion pattern would not substantially increase the survival of affected species, and diversions would likely shift to a period when other fishery resources would be affected. Altering CCWD's diversion pattern could, however, substantially affect the performance of the alternative.

CCWD's minor contribution to ongoing cumulative impacts could be mitigated through increased production rather than increased survival. CCWD could contribute to some of the fishery mitigation programs developed as part of the Two-Agency Fish Agreement. Current funding of the programs is based on direct losses of chinook salmon during SWP export. Contributions by CCWD could be bsed on CCWD diversion losses (as a proportion of SWP export losses), or estimated losses at CCWD intakes, which would require development of a monitoring program.

Cumulative Lower San Joaquin River Flow Effects on Migration and Survival

Implementation of measure 4-3 would reduce CCWD's contribution to significant cumulative impacts to less-than-significant levels for impacts to striped bass.

No mitigation measure can feasibly be implemented by CCWD that would reduce its contribution to significant cumulative impacts on Delta smelt. If the mitigation measures described under the No-Action Alternative were implemented, no cumulative impacts would occur. CCWD could appropriately contribute to those Delta-wide mitigation efforts.

Losses to Entrainment

No mitigation measure can feasibly be implemented by CCWD that would reduce its contribution to significant cumulative impacts on striped bass and Delta smelt. If the mitigation measures described under the No-Action Alternative were implemented, no cumulative impacts would occur. CCWD could appropriately contribute to those Delta-wide mitigation efforts.

Kellogg Reservoir Alternative

Mitigation measures required to reduce impacts to less-than-significant levels are identical to those described above in the "Los Vaqueros Reservoir Alternative" section. Implementing these measures would be the sole responsibility of CCWD.

Desalination/EBMUD Emergency Supply Alternative

The following measures could be implemented to reduce impacts attributable specifically to the Desalination/EBMUD Emergency Supply Alternative to less-than-significant levels. Implementing these measures would be the sole responsibility of CCWD.

Intake Facility Construction

Prevent Increased Levels of Suspended Sediments. Implementing mitigation measure 4-1 would reduce impacts to less-than-significant levels.

Restore Fisheries Habitat at the Intake and Discharge Facility Sites on Fish Habitat. Implementing mitigation measure 4-2 would reduce impacts to less-than-significant levels.

Delta-Related Impacts

Mitigation measures for significant cumulative impacts to which this alternative would contribute are identical to those described under the Los Vaqueros Reservoir Alternative.

Temperature Suitability in Rivers

No mitigation measure can feasibly be implemented by CCWD that would reduce its contribution to significant cumulative impacts on Sacramento and American River water temperatures. If the mitigation measures described under the No-Action Alternative were implemented, no cumulative impacts would occur. CCWD could appropriately contribute to those mitigation efforts.

Middle River Intake/EBMUD Emergency Supply Alternative

The following measures could be implemented to reduce impacts attributable specifically to the Middle River Intake/EBMUD Emergency Supply Alternative to less-than-significant levels. Implementing these measures would be the sole responsibility of CCWD.

Intake Facility Construction

Prevent Increased Levels of Suspended Sediment. Implementing mitigation meas-ure 4-1 would reduce impacts to less-than-significant levels.

Restore Fisheries Habitat at the Intake Facility Site. Implementing mitigation meas-ure 4-2 would reduce impacts to less-than-significant levels.

Minimize Impacts of Structural Changes at the Pipeline Crossing of Old River on Fish Habitat. Implementing mitigation measure 4-2 would reduce impacts to less-than-significant levels.

Cumulative Future Conditions

Minimize Impacts of Delta Cross Channel and Georgiana Slough Diversions on Chinook Salmon and Striped Bass

Movement of more fish into the central Delta from the Sacramento River would have significant adverse impacts on chinook salmon, striped bass, and possibly American shad and steelhead trout. Implementation of this mitigation measure would be primarily responsibility of the CVP and SWP, however, participation in funding of construction, maintenance, and operations by all agencies and individuals diverting water from Delta channels and tributaries could be negotiated based on water use.

Although an expanded Delta Cross Channel would be constructed as part of the North Delta Water Management Program, operations and structural changes to avoid additional impacts have not been identified (California Department of Water Resources 1990c). To avoid or reduce the number of fish drawn into the Delta Cross Channel and Georgiana Slough, a gate, similar to the Delta Cross Channel gates, could be constructed on Georgiana Slough at its junction with the Sacramento River. The Delta Cross Channel and Georgiana Slough gates would be closed during periods of substantial juvenile chinook salmon migration and when striped bass eggs and juveniles are present. Gate closure could worsen flow conditions in the lower San Joaquin River; therefore, operation of the gates would need to be coordinated with mitigation for the impacts of lower San Joaquin River flow changes.

Alternatively, the Delta Cross Channel and Georgiana Slough could be permanently closed and a new Delta Cross Channel connection could be constructed with fish screens at a point upstream that would ensure efficient screening of juvenile chinook salmon. Temporary closure would be required to avoid entrainment of striped bass eggs and larvae.

Minimize Impacts of Reversed Net Outflow in the Lower San Joaquin River on Chinook Salmon, Striped Bass, and Delta Smelt

As under existing conditions, reversed net outflow in portions of the San Joaquin River in the Delta would have significant adverse impacts on chinook salmon juveniles, Delta smelt larvae and juveniles, and striped bass eggs and larvae under future cumulative conditions. The mitigation objective is to increase survival of juvenile chinook salmon during migration and to move Delta smelt larvae and striped bass eggs and larvae toward Suisun Bay. Implementation would be the responsibility of the same agencies and individuals responsible implementing the above mitigation measure.

The adverse impacts of reversed net outflow on fish that have entered the San Joaquin River in the Delta could be reduced to less-than-significant levels by eliminating reverse flow in the lower San Joaquin River. Adequate San Joaquin River flow conditions could be provided by:

- closing Old River at Mossdale (assumed in place under cumulative future conditions),
- increasing San Joaquin River inflow during spring, and
- reducing Delta diversions during spring.

Survival rate of Delta smelt larvae, striped bass eggs and larvae, and possibly chinook salmon juveniles increases with higher net outflow down the San Joaquin River. Closing Old River at Mossdale would cause net seaward flow in the San Joaquin River past Stockton. Juvenile salmon would benefit from

implementation of this measure because survival rates for fish continuing down the San Joaquin River past Stockton are higher than for fish drawn into Old River at Mossdale toward the SWP and CVP pumps.

Survival of Delta smelt and striped bass, however, would increase only if the eggs and larvae are transported toward Suisun Bay and out of the Delta. Transport out of the Delta requires net outflow down the San Joaquin River. Net outflow could be achieved by reducing diversions south of the San Joaquin River, including SWP and CVP diversions, to substantially less than the San Joaquin River inflow during spring. Increased inflow and reduced Delta diversions would coincide with peak abundance of striped bass eggs and larvae, Delta smelt larvae, and chinook salmon juveniles. Although net outflow in the San Joaquin River through the Delta would need to be maintained only during periods of peak abundance, net outflow in the San Joaquin River below San Andreas may need to be maintained through the spring and early summer to ensure continued movement of juveniles and larvae toward the Bay.

Minimize impacts of Increased Entrainment in Diversions on Delta Smelt, Chinook Salmon, and Striped Bass

Entrainment in diversions would have a significant adverse impact on Delta smelt, chinook salmon, and striped bass populations. Implementation of the two cumulative future condition mitigation measures described above would reduce this impact to a less-than-significant level. Additional monitoring and operational constraints may be required for the operation of the gates on the Delta Cross Channel and new Georgiana Slough gates to reduce entrainment of winter-run chinook salmon and American shad.

Minimize Impacts of Increased Water Temperature on Spawning and Rearing Chinook Salmon

Reduced storage levels in Shasta Reservoir under cumulative future conditions could cause higher discharge temperatures and have significant adverse impacts on winter-, spring-, and fall-run chinook salmon in the Sacramento River. Although the Shasta outflow temperature control structure may be in place under future conditions, availability of cool water would limit the benefits of the structure during drier years. Operations criteria could be developed to maintain storage sufficient to ensure discharge temperatures and volumes conducive to survival of chinook salmon eggs, larvae, and juveniles in the Sacramento River between Keswick Dam and Bend Bridge.

Increased temperatures resulting from reduced reservoir storage and lower flows under cumulative future conditions could have significant adverse impacts on survival of chinook salmon eggs, larvae, and juveniles in the American River. Mitigation is the same as that recommended under the No-Action Alternative.

Minimize Impacts of Reservoir Operations on Fish Productivity in Folsom Reservoir

Lower reservoir levels and reduced spawning and rearing success could have significant adverse impacts on fish productivity in Folsom Reservoir. Mitigation is the same as that recommended under the No-Action Alternative.

Chapter 5. Delta System Water Quality

AFFECTED ENVIRONMENT

Implementation of the alternatives may result in indirect effects on Delta water quality from changes in the timing, amount, and location of water diversions. This chapter describes the California water quality regulatory framework, Delta water quality issues, Delta beneficial uses, and ambient water quality conditions at key stations in the Delta that could be affected by CCWD operations.

Overview of Water Quality Regulatory Framework

SWRCB and nine regional water quality control boards regulate water quality in California pusuant to the Porter-Cologne Water Quality Control Act. SWRCB has primary responsibility for preventing and correcting water pollution and regulating any activity or factor that may affect the quality of California's waters. Each regional board has formulated and adopted water quality control plans and policies to protect surface water and groundwater supplies within each region. Each basin plan identifies important regional water resources and their beneficial uses and provides for preventing and abating waste pollution and nuisance. Each plan also provides the basis for determining waste discharge requirements, taking enforcement actions, and evaluating clean water grant proposals. Basin plans are reviewed every 3 years.

The project area is situated within the Central Valley Regional Water Quality Control Board (CVRWQCB) jurisdictional area. The brine disposal pipeline outlet under the Desalination/EBMUD Emergency Supply Alternative is located within SFRWQCB's jurisdictional area. CCWD would be required to apply for and obtain a Clean Water Act Section 401 Water Quality Certification from SWRCB or CVRWQCB as part of the Clean Water Act Section 404 permit process.

Delta Water Quality Issues

CCWD currently diverts its water supply from the Delta and would continue to do so in the future. This section provides a brief overview of the major water quality issues in the Delta and relevant proceedings of SWRCB to resolve many of these issues.

Delta water uses include agricultural, municipal, and industrial water supply; fish and wildlife; and recreation (California State Water Resources Control Board 1975). Water for agricultural uses, such as crop and livestock production, is diverted at over 1,800 operating siphons and by seepage from Delta channels onto islands. Drainage water is returned to the Delta through pumping stations. The SWP and CVP pumps, including those serving CCWD and the North Bay Aqueduct, supply water to a combination of agricultural, industrial, and municipal users. Industrial intake and discharge points are located near Sacramento, Stockton, and Antioch. A wide variety of fish and wildlife inhabit or migrate through the Delta and many public and private recreational facilities are located throughout the Delta. Each of these water uses has associated water quality requirements and concerns.

Numerous water quality studies have been and are being conducted in the Delta, each with its own goals and objectives (California Department of Water Resources 1986, California State Water Resources

Control Board 1986, Brown 1987a). The following represent some of the recognized Delta water quality issues:

- Salinity that intrudes in the Delta during periods of low Delta outflows, especially when export pumping is high, has important ecological and economic implications.
- Delta waters have elevated trihalomethane formation potential (THMFP) levels; chloroform is a probable human carcinogen. Bromide increases THMFP levels.
- Agricultural drainage within the Delta contains high levels of nutrients, suspended sediment, THMFP, and minerals, as well as traces of pesticides. DWR has ongoing studies designed to document the effects of agricultural drainage on Delta water quality.
- Synthetic and natural contaminants have bioaccumulated in Delta fish and other aquatic life. Synthetic organic chemicals and heavy metals, such as mercury, are found in Delta fish in quantities occasionally exceeding acceptable food consumption standards (California State Water Resources Control Board 1984, 1985, 1986).
- The San Joaquin River delivers relatively poor-quality water to the Delta.
- Populations of striped bass have declined significantly from recent historical levels. Causes of the decline are unknown, although water quality conditions in the Bay and Delta are suspected of contributing to the decline, along with decreases in Delta inflow and outflow rates.
- Winter-run chinook salmon was listed as threatened by NMFS and as endangered by DFG in August of 1989. Winter-run chinook salmon occur in the Delta and could be potentially affected by Delta diversions and exports.

A review of selected studies and ongoing programs, summarized in the following paragraphs, indicates a high level of interest and concern about Delta water quality.

Interagency Ecological Study Program of the Sacramento-San Joaquin Estuary

The Interagency Ecological Study Program of the Sacramento-San Joaquin Estuary was initiated in 1970 by DWR, DFG, Reclamation, and USFWS to provide more information about the effects of CVP and SWP exports on fish and wildlife problems in the Bay-Delta estuary. This information is intended to minimize detrimental effects on aquatic resources during operation of the water projects. Fisheries components were designed to document habitat requirements and the general food-web relationships of estuarine and migratory species. Water quality components were focused on salinity and algal productivity effects.

Municipal Water Quality Investigations Program and the Interagency Delta Health Aspects Monitoring Program

The Municipal Water Quality Investigation Program, formerly the Interagency Delta Health Aspects Monitoring Program (IDHAMP), in which CCWD is a participant, was initiated in 1983 to provide a reliable and comprehensive source of water quality information for judging the suitability of the Delta as a source of drinking water (California Department of Water Resources 1989a). (Although IDHAMP is now entitled the Municipal Water Quality Investigation Program, IDHAMP is used throughout this report.) DWR established IDHAMP in response to scientific advisory council recommendations (California Department of Water Resources 1982) to assess the human health aspects of Delta water supplies. Issues of concern included sodium, asbestos, and THMFP concentrations in Delta water. A standardized test for THMFP levels was adopted.

As the program has proceeded, additional variables and issues have emerged. Pesticide residues in water have been tested, the contribution of organic materials and THMFP from agriculture drains and algal biomass in the Delta has been studied, and the ionic composition of inflowing rivers and exported water has been compared to provide a means of chemically tracking the movement of water through the Delta.

IDHAMP studies have documented relatively high THMFP concentrations in Delta water exports. The Sacramento and San Joaquin Rivers have low to moderate THMFP values. Agricultural drainage discharges containing natural decomposition products of peat soil and crop residues are considered probable sources of the THMFP increase in Delta waters.

Bromide concentrations in Delta water have recently been determined to contribute a significant portion of the THMFP concentrations observed at the export locations. This ion is associated with chloride in seawater and may also be present in the inflowing river water. Bromide measurements are relatively difficult to obtain and were not made part of the IDHAMP study until January 1990.

Delta Agricultural Drainage Studies

Agricultural drainage has been identified as a contributor to declining water quality conditions in many Central Valley rivers. Researchers at the University of California, Davis, have demonstrated that water from the Colusa Basin Drain contributes significant amounts of sediment, nutrients, and herbicides to the Sacramento River. Drainage water typically has moderate to high levels of nutrients, high levels of TDS and suspended solids (SS), and detectable concentrations of agricultural chemicals (University of California, Davis 1980).

DWR is investigating the quality of Delta agricultural waters through the Delta Island Drainage Investigation (DIDI), a special agricultural drainage investigation under IDHAMP. The investigation has identified and mapped discharge points of irrigation return water in the Delta. Initiated in 1985, the investigation has focused on Empire Tract, Grand Island, and Tyler Island, collecting monthly data from agricultural drains on these islands. Approximately 45 new monitoring stations were added to the program in 1987, allowing a much broader interpretation of results between islands with different soil and farming practices.

In general, intensive surveys of agricultural drains on Delta islands have shown high THMFP levels and indicate a significant contribution to organic THM precursor material in Delta waters (California Department of Water Resources 1990a). The salt content of the drainage water is generally higher than that of the corresponding irrigation water and is greatest during October-March as a result of intentional salt leaching from the Delta islands, which is necessary between growing seasons to maintain the soils' agricultural viability.

D-1485 Standards Monitoring Program

SWRCB's D-1485 in August 1978 amended previous water rights permits of DWR and Reclamation for the SWP and CVP facilities. It also set numerical water quality standards for Delta outflow, EC, and chloride to protect three broad categories of beneficial uses: fish and wildlife, agriculture, and municipal and industrial uses. The standards included adjustments to reflect changes in hydrologic conditions under different water-year types (California State Water Resources Control Board 1978b).

Delta outflow, export rates, EC, and chloride are the parameters regulated in D-1485. DWR and Reclamation are responsible for monitoring water quality conditions in the Delta and adjusting their operations to satisfy the applicable D-1485 standards. Monitoring stations extend from near Courtland on the Sacramento River and near Vernalis on the San Joaquin River, throughout the Delta, and from Suisun Bay to San Pablo Bay. Figure 5-1 shows Delta monitoring stations. Reports on observed water quality

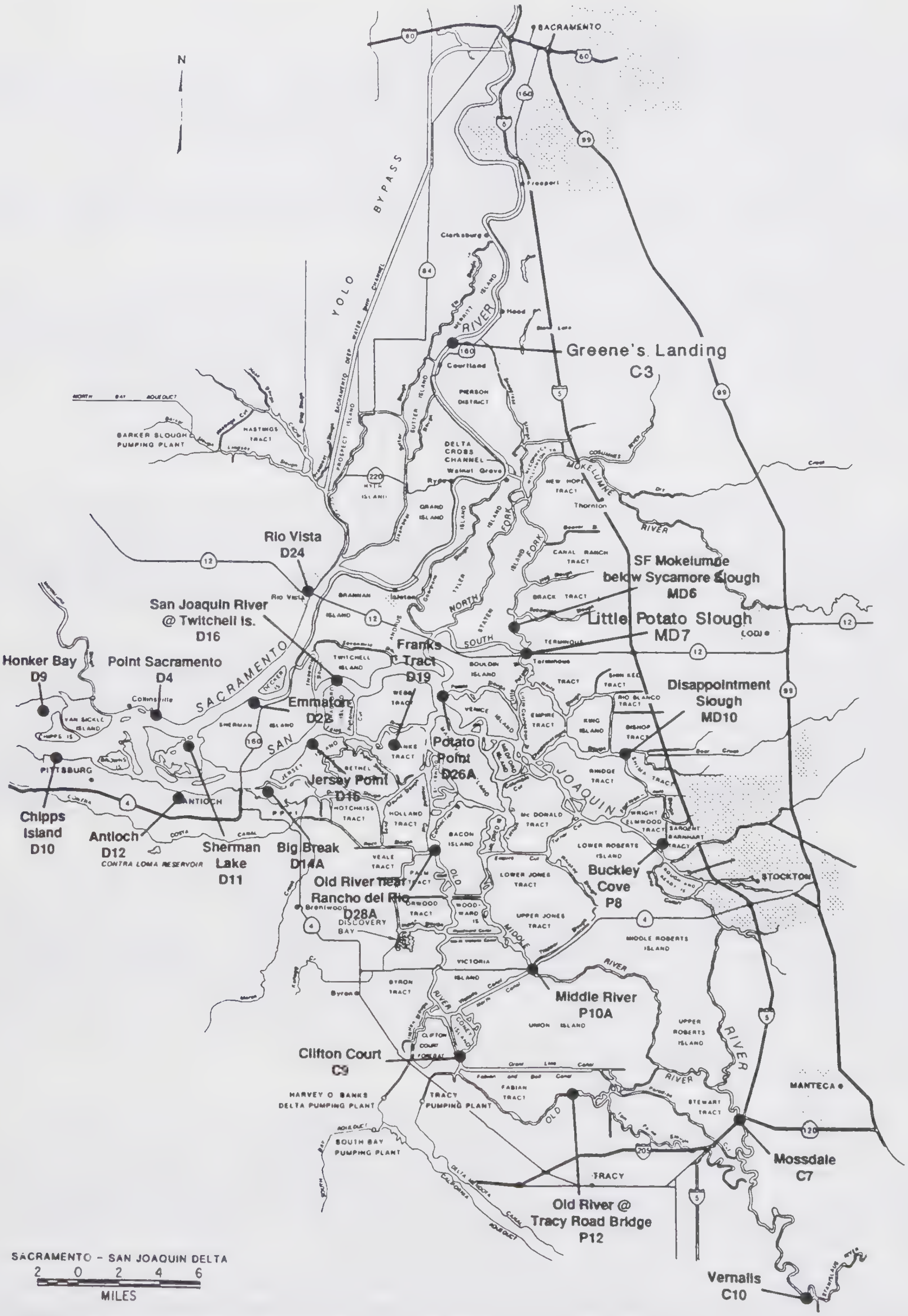


Figure 5-1. Delta Water Quality Monitoring Locations

Source: DWR 1987b

conditions in the Delta and compliance with limits set in D-1485 are prepared annually (California Department of Water Resources 1989c).

The EC monitor records at Jersey Point and Emmaton are especially important for Delta operations that involve upstream reservoir releases and export pumping limits needed to satisfy D-1485 water quality standards. Both CVP and SWP operations staff have access to telemetered data from many other EC monitors. A daily flow and EC data report is prepared and distributed by the DWR Delta Operations Water Quality Section to assist in operational decisions.

Existing Water Quality Conditions

Introduction

The base case for purposes of analysis is existing conditions. The project alternatives are examined under both existing and future conditions. To clearly describe project alternative impacts, the future condition, No-Action Alternative, is also analyzed.

NEPA and CEQA require that project impacts be compared to a no-action alternative. The project alternatives have been analyzed and compared with a no-action alternative, assuming existing and future conditions. These analyses are presented to meet the requirements of NEPA and CEQA and provide decision makers with a more complete analysis of the impacts of the project alternatives. They also aid CCWD's evaluation of future implications of a project designed to serve its long-term requirements.

Delta Water Quality

Existing Delta water quality conditions form the basis for comparing the water quality effects of the project alternatives. This section describes water quality trends at 10 Delta locations as simulated with the FDM. The results represent the baseline conditions without the project alternatives under existing water demand conditions.

Water quality conditions at any one Delta location vary depending upon water-year type, proximity to waste discharges, and time of year. Figure 5-2 provides plots of baseline conditions for each modeled station. The following discussion of Delta water quality trends are described on a regional basis because trends are similar for many stations, although the magnitude and duration of salinities vary considerably depending on the location in the Delta.

Western Delta Stations. The western Delta stations are Antioch, Emmaton, and Jersey Point. These stations generally exhibit wide ranges in salinity levels that depend strongly on Delta outflow levels. Extended periods of high salinity levels tend to occur during dry periods and low salinity levels tend to occur during wet periods. The drought periods, 1929-1934 and 1976-1977, are easily discernable in Figure 5-2.

Old River Stations. These stations are Old River at Rock Slough, Rock Slough at Contra Costa Canal, Old River at Highway 4, Clifton Court Forebay entrance, and Tracy Pumping Plant. While these stations exhibit varied salinity levels, the range is much smaller than in the western Delta. Stations to the north in Old River tend to have higher salinity, especially in dry periods. Again, drought periods are clearly discernable in Figure 5-2.

Interior Delta Stations. These stations are Middle River at Woodward Island and San Joaquin River at San Andreas Landing. The salinity ranges tend to be low for these stations, although salinities increase in dry periods with low outflows.

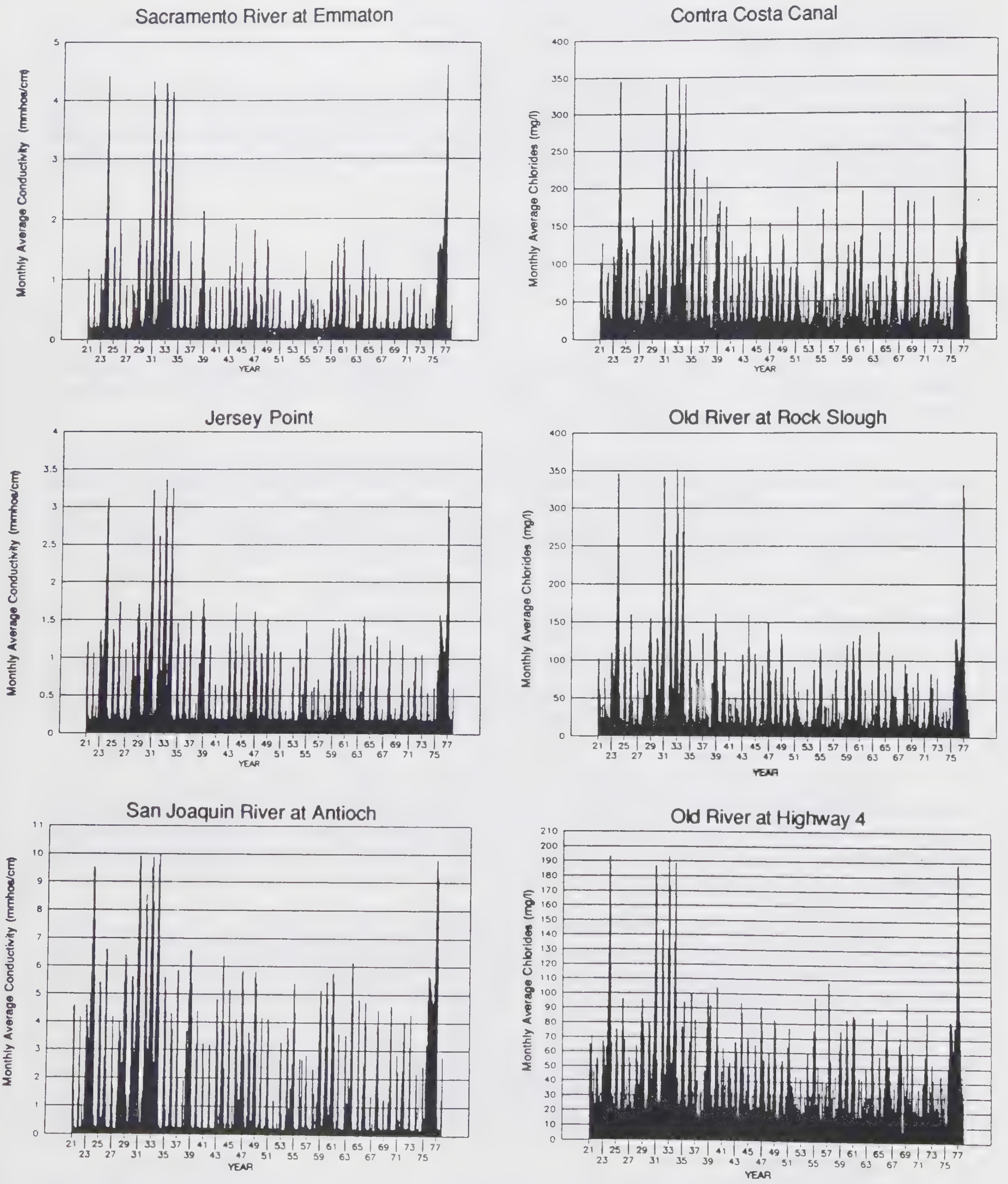


Figure 5-2. Water Quality Trends at 10 Delta Locations

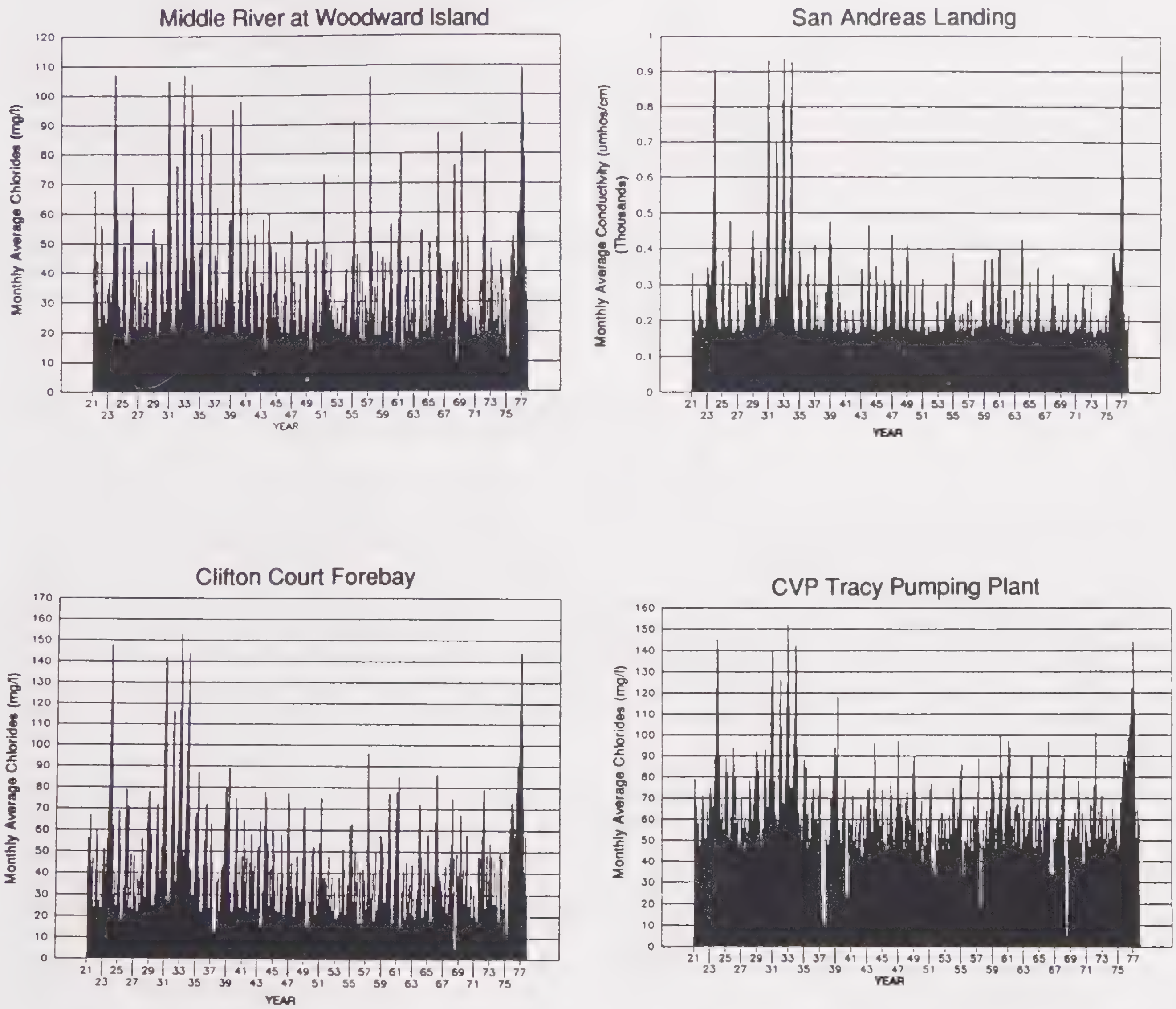


Figure 5-2. Water quality Trends at 10 Delta Locations (Continued)

ENVIRONMENTAL CONSEQUENCES

Water quality conditions in the Delta are an important issue for many in-basin and export water users. Delta water is used for a wide range of beneficial uses including municipal and industrial supply, agricultural irrigation, and fish and wildlife maintenance. Alterations of the Delta flow regime can affect water quality, and therefore affect beneficial uses. Assessing and describing the effects of Delta water diversions on beneficial uses is essential to project development and important to many water users.

Evaluating the potential effects of the project alternatives on Delta salinity quality was accomplished using the FDM. Salinity is the most widely used indicator of mineral content of Delta water. Well-documented relationships exist between salinity expressed in terms of TDS or chlorides and electrical conductivity, of which there are extensive long-term field measurements in the Delta.

Delta Water Quality Impact Assessment Methodology

The water quality impact analysis uses the output from several models: DWRSIM, FDM, and LVOPS. The general characteristics of these models and the relationships between them are summarized below.

DWRSIM simulates reservoir and Delta pumping operations of the major Central Valley water resource projects (CVP and SWP). DWRSIM uses projected land and water use in the Sacramento Valley and Delta together with assumptions of the flows required in the Delta to meet salinity control requirements. DWRSIM provides estimates of monthly Delta inflow, outflow, and project exports. Delta flow estimates from DWRSIM are used in the FDM to simulate Delta hydrodynamics and salt concentrations. It is important to note that DWRSIM uses monthly time steps, and the input hydrologies are estimates based on projected future land development.

The FDM is a numerical salinity model of the Delta region developed by the late Hugo B. Fischer for Reclamation and DWR. The model solves the hydrodynamic and salinity transport equations on a mathematical representation of the Delta channel network. The model simulates time-varying flows and salinity levels as a function of inflows, diversions, and tides. In these studies, Version 8 was used. Version 8 is a variant of Version 7, the official version. If Reclamation staff had done the impact analysis, Version 7 of the FDM would have been used in a steady-state mode to estimate salinity impacts. However, Reclamation staff believe that Version 8 is adequate for the purposes of this EIR/EIS. It is designed to simulate salinity changes in the Delta as affected by physical and hydrological changes in the Delta, but it can also be used to simulate the movement of pollutants from point sources. The model is intended to be used in engineering studies on the effects of levee breaks, changes in Delta flow, changes in discharges or water consumption in the Delta, installation of control structures, or changes in water project operations.

LVOPS simulates project alternative operations, including the times and quantities of Delta diversions, according to rules specified by CCWD. The timing of diversions is determined, in part, using Delta salinity computed by the FDM.

FDM results of monthly average salinity forms the basis for the water quality impact assessment and for formulating comparisons among the alternatives. Simulated salinity results for representative Delta locations were developed for all alternatives and used in the impact analysis.

The FDM simulates flows and salinity throughout the Delta. Ten stations were selected for detailed analysis because of their location in the Delta, their proximity to the project alternative intake locations, and their importance to beneficial uses of Delta water.

The representative Delta stations are as follows:

- Western Delta stations:
  - Sacramento River at Emmaton*,
  - San Joaquin River at Jersey Point*, and
  - San Joaquin River at Antioch;*

- Old River stations:
  - Old River at Rock Slough,
  - Rock Slough at Contra Costa Canal Intake*,
  - Old River at Highway 4,
  - Clifton Court Forebay*, and
  - CVP Tracy Pumping Plant*; and

- Interior Delta Stations:
  - Middle River near Woodward Island and
  - San Joaquin River at San Andreas Landing*.

The stations marked with an asterisk are D-1485 monitoring stations.

Comparisons of salinity simulations under existing conditions indicate that most changes in salinity at the stations caused by the project alternatives are very small and infrequent. However, under future conditions, substantial changes are found for specific months because of operations associated with projected future water demands. The studies indicate that the results under future conditions as compared to present conditions require further detailed analysis.

Impact Analysis Initial Screening Procedure

An initial screening procedure was developed to help identify Delta water quality impacts for each alternative. The procedure is designed to remove from consideration individual Delta salinity changes that are clearly small compared to the precision of measurements and modeling results. Calculated salinities for each station were converted to applicable D-1485 units using regression equations developed by DWR (Bay-Delta Phase I Exhibit DWR-61). Salinity simulations at 10 Delta stations under project alternatives were compared with simulating existing salinity levels for the 57-year period of simulation, totaling 684 months. Differences were considered for more detailed impact analysis if they met either of the following screening criteria:

- **Screening Criterion 1**

  - salinity differences for the project alternative are greater than 5% of the base condition and

  - salinity differences between project alternatives and the base case are greater than 5 mg/l chloride or 20 micromhos per centimeter (μmhos/cm) EC.

- **Screening Criterion 2**

  - for Delta locations where D-1485 applies, when base salinity levels are greater than 95% of the applicable D-1485 standard and the alternative causes *any* increase in salinity levels. This criterion recognizes potential significance of project operations when Delta salinity approaches regulatory limits.

Salinity increases or decreases of less than 5% of base conditions are insignificant because changes of this magnitude are clearly smaller than the uncertainty in the field measurements and the modeling

methods. The additional 5 mg/l or 20 μmhos/cm criterion removes from consideration very small changes under low salinity conditions.

The second criterion was established to ensure that all increases are reviewed when calculated salinity levels approach regulatory limits. This does not mean that the salinity levels would in fact approach regulatory limits. It is important to remember that those simulations are based on estimated hydrologies, monthly average flows, and 19-year mean tides.

This initial screening procedure eliminates changes that are clearly insignificant. Individual values that pass the screening criteria, however, are not necessarily significant. Conclusions of significance are reached after review of the changes in terms of the frequency, magnitude, and duration of salinity increases and decreases.

CCWD recognizes that efforts have been underway for some time to modify D-1485 water quality standards. It is not possible at this time, however, to determine what possible future standards might be in sufficient detail to conduct a meaningful analysis of impacts. In addition, until new standards are adopted, the standards adopted through D-1485 remain in place.

Criteria for Conclusions of Significance

Significant Impacts

Significant adverse impacts were determined using the following criteria:

- results meet either of the initial screening criteria; and
- review of results meeting screening criteria show distinct periodic or seasonal trends or continuous increases throughout a substantial portion of the simulation period; or
- the frequency of salinity increases over the 57-year period is substantially greater than the frequency of salinity decreases (e.g., salinity levels predicted to increase 70% of the time and decrease 30% of the time); or
- the frequency, magnitude, and duration of salinity increases are consistent during certain water-year types or Delta conditions (e.g., consistent increases in dry or critical years); or
- trends in salinity increases are consistent at several Delta stations or over well-defined geographic areas; or
- salinity changes have the potential to affect beneficial uses or CCWD operations.

Beneficial Impacts

Impacts were considered beneficial if an alternative would improve the quality of Delta water for beneficial uses without causing adverse cumulative short-term or long-term impacts on water quality and quantity.

Less-than-Significant Impacts

Impacts were considered less than significant if an increase was an isolated event, did not follow a consistent trend, or the magnitude of increase was small compared to the base case salinity.

Summary of Water Quality Analysis Results

This section provides a brief overview of the effects of the project alternatives on Delta water quality under both existing and future water demand conditions. Subsequent sections in this chapter provide more detailed technical analysis and discussion of water quality impacts at various locations in the Delta under both conditions. The purpose of this section is to provide a generalized description of potential water quality effects in the Delta resulting from operation of the project alternatives. The water quality impact analysis shows that the effects of the project alternatives are very small and that the magnitude of the effects does not vary substantially under any of the water demand conditions analyzed.

The following impact analysis estimates the effects of the project alternatives by comparing the computed salinities of the alternatives to those of existing conditions. This approach to the water quality impact analysis concentrates on changes in Delta salinity. It assumes that the changes attributed to the project alternatives are caused by modifications to the schedule of CCWD diversions from the Delta or by changes in CVP or SWP operations made in response to modified CCWD diversions. Analysis of model results may identify simulated impacts, caused by model characteristics, that would not necessarily occur in actual operations.

Delta salinity is affected by the quality of tributary inflows, local discharges of agricultural drainage, and seawater intrusion from the Bay. The transport of salts from these sources to points in the Delta is affected by the distribution of flows between the Delta channels, including substantial tidal flows. Flow quantities are regulated by tributary inflows and by diversions and exports from the Delta. A principal factor in determining the degree of seawater intrusion is the rate of outflow from the Delta to the Bay. These factors and the relationships between them are accounted for by the FDM.

The impact discussion in the following sections contains five distinct analyses. The structure and purpose of these analyses are described below. The impact discussion includes a detailed description of simulated existing salinity concentrations at key points in the Delta. This analysis provides a basis for comparing all the alternatives. Another of the analyses compares the water quality effects of the project alternatives under existing water demand conditions to existing conditions without the project alternatives.

Projected future water quality conditions are also described assuming that none of the project alternatives described in this EIR/EIS are implemented (No-Action Alternative). This analysis provides a baseline for discussing the water quality effects of the project alternatives under projected future water demand conditions. The water quality effects of the project alternatives under future conditions are compared to existing conditions (base case) and to the No-Action Alternative, and simulated incremental changes in salinity attributable to the project alternatives are identified.

Projected water quality conditions under the No-Action Alternative are compared to existing conditions. The purpose of this analysis is to describe the changes in Delta water quality that would occur assuming that no project alternatives are implemented and all water users, including CCWD, increase diversions in accordance with water rights, contracts, or other entitlements. By separately describing the water quality effects of the No-Action Alternative, this analysis describes the total changes in simulated water quality conditions that would occur under the project alternatives under future conditions and also allows a clear comparison of the incremental water quality effects of the project alternatives under future conditions.

Finally, the projected effects of the project alternatives combined with other Delta water projects are discussed. This cumulative future impact analysis is more general because methods used in the draft environmental documents describing other projects are different from those used in this analysis, and the documents may be revised substantially before being released in final form.

Generally, the simulated salinity varied only slightly between existing conditions and the No-Action Alternative, and the project alternatives, with very few salinity changes meeting the initial screening criteria at most Delta stations analyzed. Water quality impacts varied by water-year type and location in the Delta. The Desalination/EBMUD Emergency Supply Alternative and the Middle River Intake/EBMUD Emergency Supply Alternative resulted in little or no change in Delta water quality conditions because these alternatives only slightly alter the quantity or location of CCWD diversions.

The primary water quality effects associated with any of the project alternatives are caused by altered flow patterns under the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives during dry and critical years when CCWD is relying on the reservoirs for a portion of its supply. The altered flow patterns lead to small local changes in salinity. The reservoir alternatives may also allow retention of water in storage at CVP and SWP reservoirs during these periods. Water made available in this way could be used for other purposes.

No-Action Alternative

General Discussion

Water quality conditions associated with the No-Action Alternative represent the water quality conditions at buildout of CVP and SWP water demands. Model simulations include future water demands for CCWD and other CVP and SWP users. Improvements in Delta water transfer facilities are not included except for the simulation of additional pumping capacity at SWP's Harvey O. Banks Pumping Plant. This No-Action Alternative analysis provides a future baseline against which to compare the effects of the project alternatives.

The future condition assumes that SWP and CVP Delta demands increase from 6.6 million af to 7.2 million af. Attempts to satisfy the higher demand would require facilities to operate closer to the limits of regulatory and contractual constraints. Under these conditions, adverse effects would be expected to be emphasized. During dry periods, Delta salinity levels are higher that during wet periods. Small changes in CVP and SWP operations may result in greater salinity changes in dry periods than when flows are higher. Thus, the assumed higher future demands will tend to emphasize salinity increases during dry periods.

Future CVP and SWP Operations

The assumed future conditions are similar to the existing conditions except that the CVP and SWP place a larger demand on the Delta water supply. The reaction of the CVP and SWP to the larger demands is modeled with the DWRSIM model. Note that larger demands do not always result in greater Delta diversions: in dry periods, deficiencies may be imposed and the total demand may not be met.

Attempts to meet the higher demands result in operational changes. CVP and SWP management would be more constrained and require more control. In comparison with a lower demand situation, reservoir releases and Delta diversions may be altered considerably, especially in dry years.

For example, when demands are relatively low, more flexibility may occur with respect to the timing of reservoir releases and downstream diversions over a summer. However, when demands are higher, releases may need to be made at a constant rate throughout summer. The downstream flow patterns could

be very different in the two cases. Further, CVP and SWP reservoir levels would tend to be lower in the high demand case at the beginning of the wet season, so the reservoir would be refilled over a longer period, altering the downstream flows from the low demand case. In either of these examples, month-to-month variations in flows can be expected. These variations would often be simple shifts from one month to another, but would sometimes be more complex shifts.

Comparisons of salinity results from a future level of demand with those of an existing level of demand may produce one of two patterns. Month-to-month variations in flow, with some higher and some lower, may result in Delta salinity fluctuations. To the extent that these fluctuations reflect the redistribution of flows, they may be insignificant. An individual event in these circumstances does not represent the impacts associated with these types of operational changes. However, increased demand would reduce the water available for Delta outflow and salinity control, particularly in dry periods. The degree of salinity increase will depend on several factors, including the timing of the reductions in outflow.

Delta Water Quality

The following discussion describes the water quality conditions assumed under the No-Action Alternative and compares them to existing conditions. The comparison illustrates how increased demands may affect salinity levels as described above. It also separates the impacts of project alternatives from those associated with a change in conditions unrelated to the project alternatives.

Subsequent sections demonstrate, through examination of the No-Action Alternative, that the impacts associated with the project alternatives are small, regardless the level of demand.

The monthly averaged salinity levels from the FDM calculations for the 10 stations of interest are presented in tabular form in the Stage 2 EIR/EIS Technical Report (bound separately). Comparisons with the existing conditions are presented in Figure 5-3.

The calculated salinity levels were screened according to the criteria discussed in previous sections. Results of the screening are presented in the Stage 2 EIR/EIS Technical Report (bound separately) in tabular form and are summarized in Table 5-1.

In general, the calculated salinities show similar trends as found in the base case. Salinity levels vary over a wide range according to hydrologic conditions; the range is especially wide in the western Delta and smaller in the interior. Drought periods exhibit high salinities for extended periods.

Western Delta Stations. Stations in the western Delta (Antioch, Emmaton, and Jersey Point) show patterns similar to those in the base case (Figure 5-3). Note that while there are month-to-month variations, many of these variations are attributable to a shift in flow patterns: an increase or decrease in salinity is often followed by a reversal in the trend.

Two notable increases in salinity occurred in 1929 and 1976: these increases resulted from relaxations of the Antioch salinity standard in April, which is allowed under D-1485. Larger deficiencies are taken by water users compared to the base case because of the increased demands and the Antioch standard is relaxed based on the size of the deficiency.

The screening revealed a few cases when increases in salinity occurred at Antioch and the calculated base case was above 95% of the standard. These were isolated cases, and the increases were small (217 μmhos/cm or less). Although indicative of the general trend toward higher diversions and lower outflows, the infrequency combined with the small magnitude of the increase indicates that impacts would be less than significant.

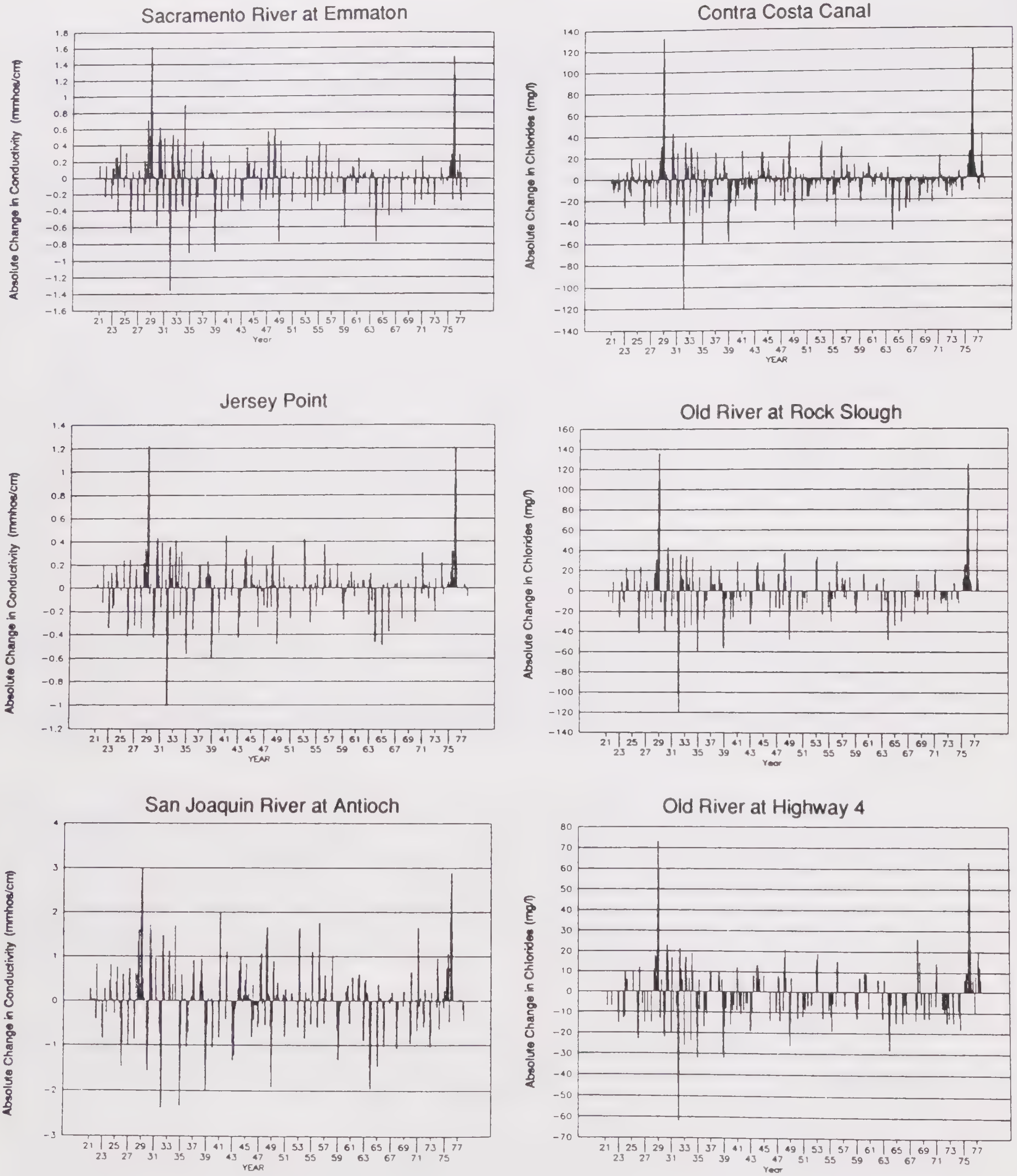


Figure 5-3. Water Quality Trends at 10 Delta Locations under the No-Action Alternative

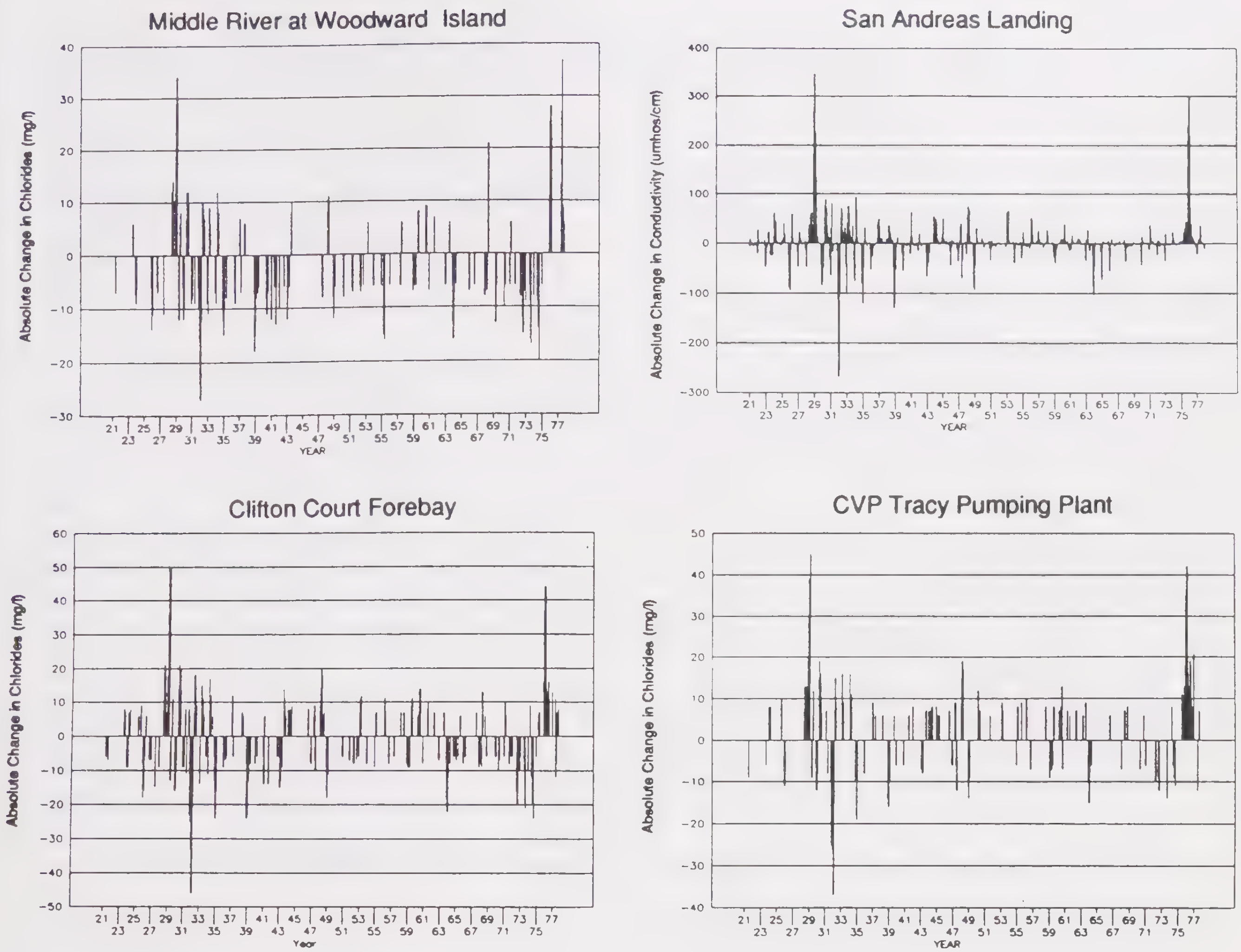


Figure 5-3. Water Quality Trends at 10 Delta Locations under the No-Action Alternative (Continued)

Table 5-1. Summary Statistics for Simulated Effects Under the No-Action Alternative at 10 Delta Locations Compared to Existing Conditions

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	129	19	163	24	0
San Joaquin River at Jersey Point	114	17	181	27	2
Old River at Rock Slough	130	19	126	18	0
Contra Costa Canal Intake	166	24	115	17	6
San Joaquin River at San Andreas	65	10	83	12	0
San Joaquin River at Antioch	143	21	232	34	3
Old River at Highway 4	133	19	92	14	0
Middle River near Woodward Island	112	16	49	7	0
Clifton Court Forebay	124	18	101	15	0
CVP Tracy Pumping Plant	59	9	93	14	0

The two cases for Jersey Point are small increases during August in two separate years. The standard is enforced until August 15, but the data are averages for the entire month. These increases would be less than significant.

An examination of Figure 5-3 and Table 5-1 reveals that at these locations the general trend is an increasing salinity level. The number of months with increases substantially exceeds those with decreases and the plots show that, especially in the dry periods, the salinity levels tend to be higher. This would be a significant adverse impact because the frequency and magnitude of salinity increase are substantial and are evident at a number of Delta locations.

Old River Stations. Comparisons with the base case are shown in Figure 5-3.

The comparisons for these stations also show month-to-month variations, but the range is much smaller that in the western Delta. The only large changes are found in 1929 and 1976, and the end of summer. These are the result of lower outflows calculated for these months. The lower outflows are the result of changed operations because of the increased demand on the system. The two events are similar in that they both occur in the first year of multiyear droughts.

The only station that showed a salinity increase when the calculated level was above 95% of the standard is Rock Slough. Five of the six events involved increases that were, at most, 5 mg/l chlorides. The other event involved an increase of 20 mg/l, which would not be significant because it is an isolated event. Again, it is an indicator of the general trend caused by the larger demands.

In general, the decreases in salinity outnumber the increases by a small amount, except in the dry periods, and would be less than significant. Decreasing salinities are caused in general by a redistribution of flows. In Rock Slough, decreased salinity levels often occur in winter: this is caused by an increase in flow through Rock Slough (when compared to existing conditions), which allows a greater dilution of agricultural return flows discharged into Rock Slough.

Interior Delta Stations. The comparisons of the interior stations are shown in Figure 5-3.

These stations show trends similar to those found in the Old River stations, except that the range of variation is smaller.

Los Vaqueros Reservoir Alternative

Construction-Related Impacts

Vasco Road and Utility Relocations. This analysis incorporates, by reference, the water quality impact analysis and findings from the Vasco Road and Utility Relocation Project EIR. The following description is a synopsis of the water quality impacts from that project.

Significant water quality impacts identified in the EIR were identical for the road, electric transmission line, natural gas pipeline, and petroleum pipeline relocation alternatives. These impacts relate to increased erosion during construction and the transport of soils to local waterways. The impacts were considered significant but were mitigated to less-than-significant levels through adoption of soil erosion and pollutant control measures by CCWD.

Kellogg Creek Water Quality. Construction of the dam for the Los Vaqueros Reservoir is not expected to have significant impacts on Kellogg Creek water quality. CCWD proposes to install a temporary pipe to divert the creek around the construction area and convey water back into the creek downstream of

the construction area. A small portion of the creek would be dewatered where the dam would be constructed.

Water Conveyance Pipeline Construction. The construction of water conveyance pipelines associated with this alternative would require that trenches be dug with heavy equipment, exposing soils to erosion and possibly increasing turbidity and soil deposition in stream channels. In addition, the presence of construction equipment would increase the risk of oil and grease entering local drainages. These potential impacts would be significant.

Intake Facility Construction. Construction of the intake structure may cause short-term temporary increases in turbidity and suspended sediment downstream of the construction site in Old River. Increases in turbidity and suspended sediment can have detrimental effects on Delta fish and downstream water users. Turbidity increases would be less than significant because in-river construction activities should be completed in several days and CCWD proposes to utilize measures to minimize turbidity impacts. Specifically, large sheet piles would be installed to isolate the construction area and the enclosed area would be dewatered. Small volumes of seepage water would be discharged to Old River on an as-needed basis.

CCWD would most likely be required to obtain a permit under Section 10 of the Rivers and Harbors Act of 1899 for construction of the intake structure. As part of the permit approval process, CVRWQCB would comment on CCWD's permit application, requiring various measures to minimize turbidity and SS in Old River. CVRWQCB would require that downstream water quality be monitored.

Delta Water Quality - Existing Conditions

The Los Vaqueros Reservoir Alternative would include constructing a new supplemental intake structure and pumping plant on Old River or at Clifton Court Forebay. In general, this alternative would enable CCWD to use more surplus water and decrease CCWD diversions when salinity levels are high. FDM salinity simulations provide the basis for identifying potential changes or shifts in Delta water quality. The simulated salinity for the project alternatives is presented in the Stage 2 EIR/EIS Technical Report (bound separately).

Rock Slough/Old River Configurations. Table 5-2 summarizes salinity levels under this alternative compared to existing conditions, and Figures 5-4 through 5-13 show the comparisons in graphical form.

Western Delta Stations. The alternative does not significantly alter the salinity in the western Delta. As can be seen in Table 5-2, only a few months passed the screening criteria. The increases found when salinity levels exceeded 95% of the D-1485 standard were small (increases less than 10 μmhos/cm) and infrequent. These increases would be less than significant.

Old River Stations and Interior Delta Stations. With the exception of Rock Slough at the Contra Costa Canal and Old River at Highway 4, all changes in salinity caused by this alternative were less than significant.

At Old River at Highway 4, several instances were found where the salinity increased relative to the base case. One calculated increase was 15 mg/l of chlorides; the rest were all less than 10 mg/l of chlorides. They were generally found in late summer of dry years.

The cause of the increases can be attributed to the changes in location of the CCWD diversions. Under this alternative, less water would be diverted from Rock Slough and more would be diverted at Old River at Highway 4. This change tends to alter the flow pattern in Old River; the effect of the alteration is small because the diversions involved are small compared to the channel flows. The effects are local: no significant changes were found in Old River at Rock Slough, for example, nor at the intake to Clifton Court Forebay.

Table 5-2. Summary Statistics for Simulated Effects of Los Vaqueros Reservoir Alternative - Rock Slough/Old River Configurations at 10 Delta Locations under Existing Conditions

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	0	0	0	0	3
San Joaquin River at Jersey Point	0	0	1	<1	3
Old River at Rock Slough	0	0	0	0	0
Contra Costa Canal Intake	57	8	235	34	7
San Joaquin River at San Andreas	0	0	0	0	0
San Joaquin River at Antioch	3	<1	0	0	10
Old River at Highway 4	2	<1	9	1	0
Middle River near Woodward Island	0	0	1	<1	0
Clifton Court Forebay	0	0	0	0	0
CVP Tracy Pumping Plant	0	0	0	0	0

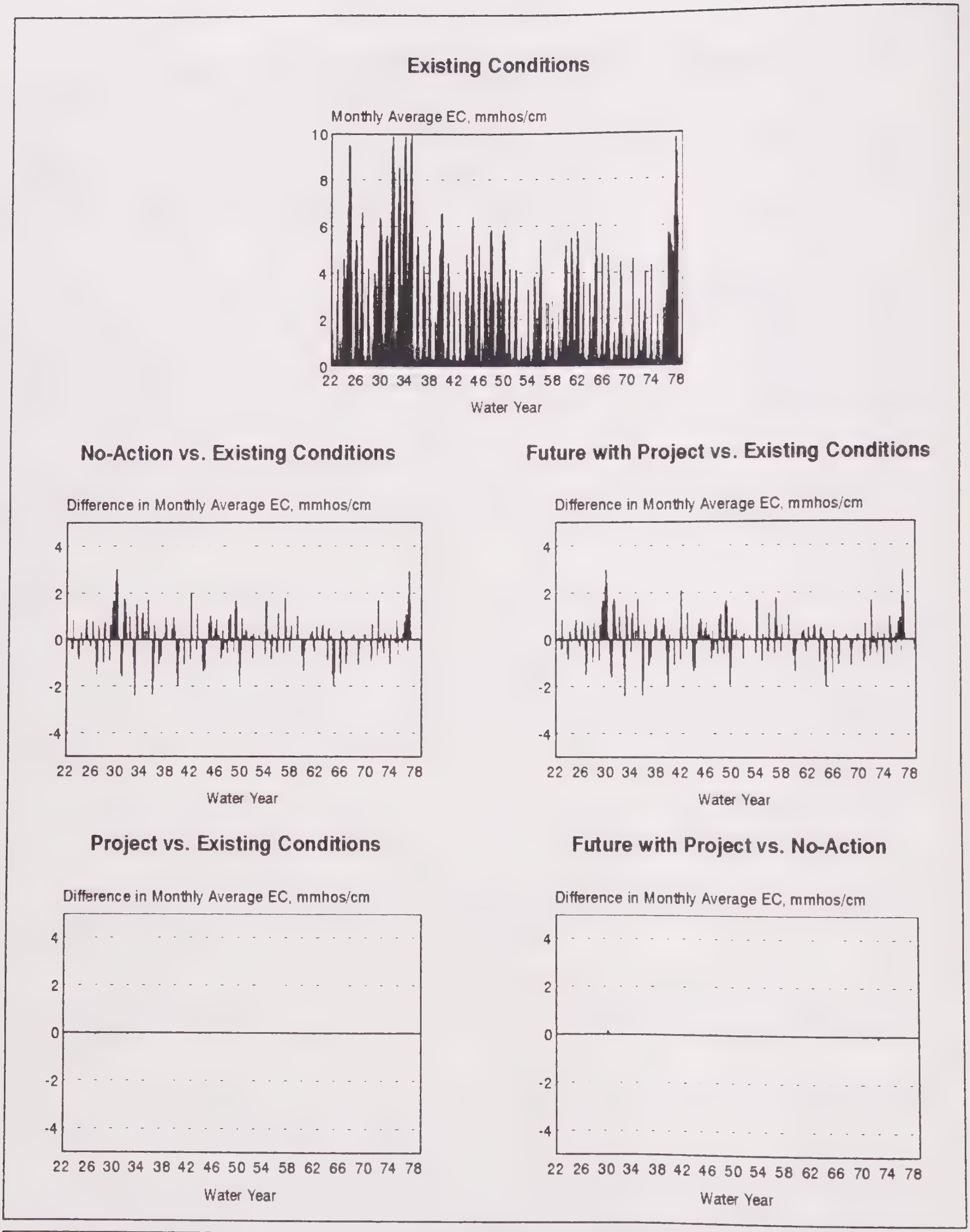


Figure 5-4. Estimated Salinity Impacts
San Joaquin River at Antioch
Rock Slough/Old River Configuration

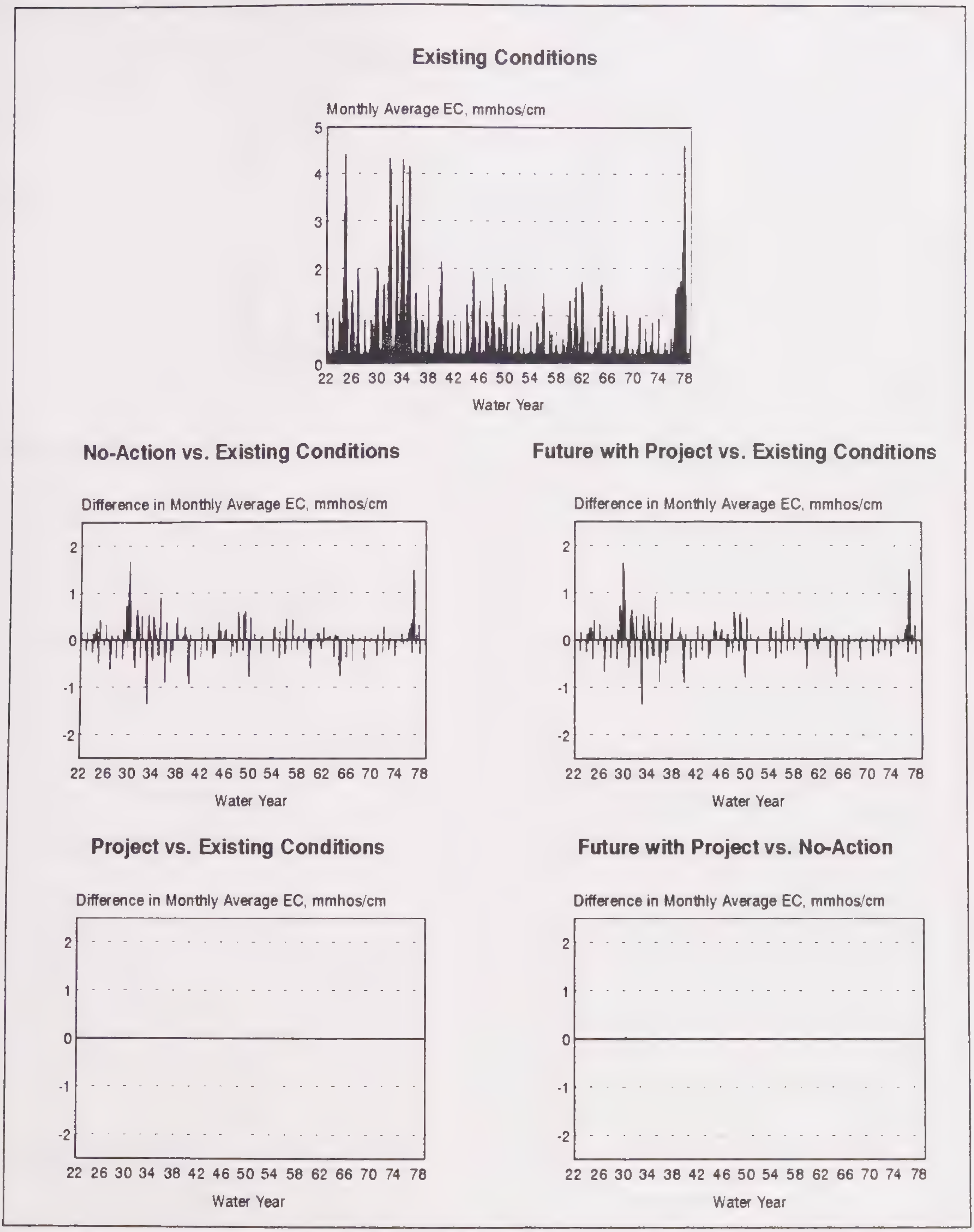


Figure 5-5. Estimated Salinity Impacts
Sacramento River at Emmaton
Rock Slough/Old River Configuration

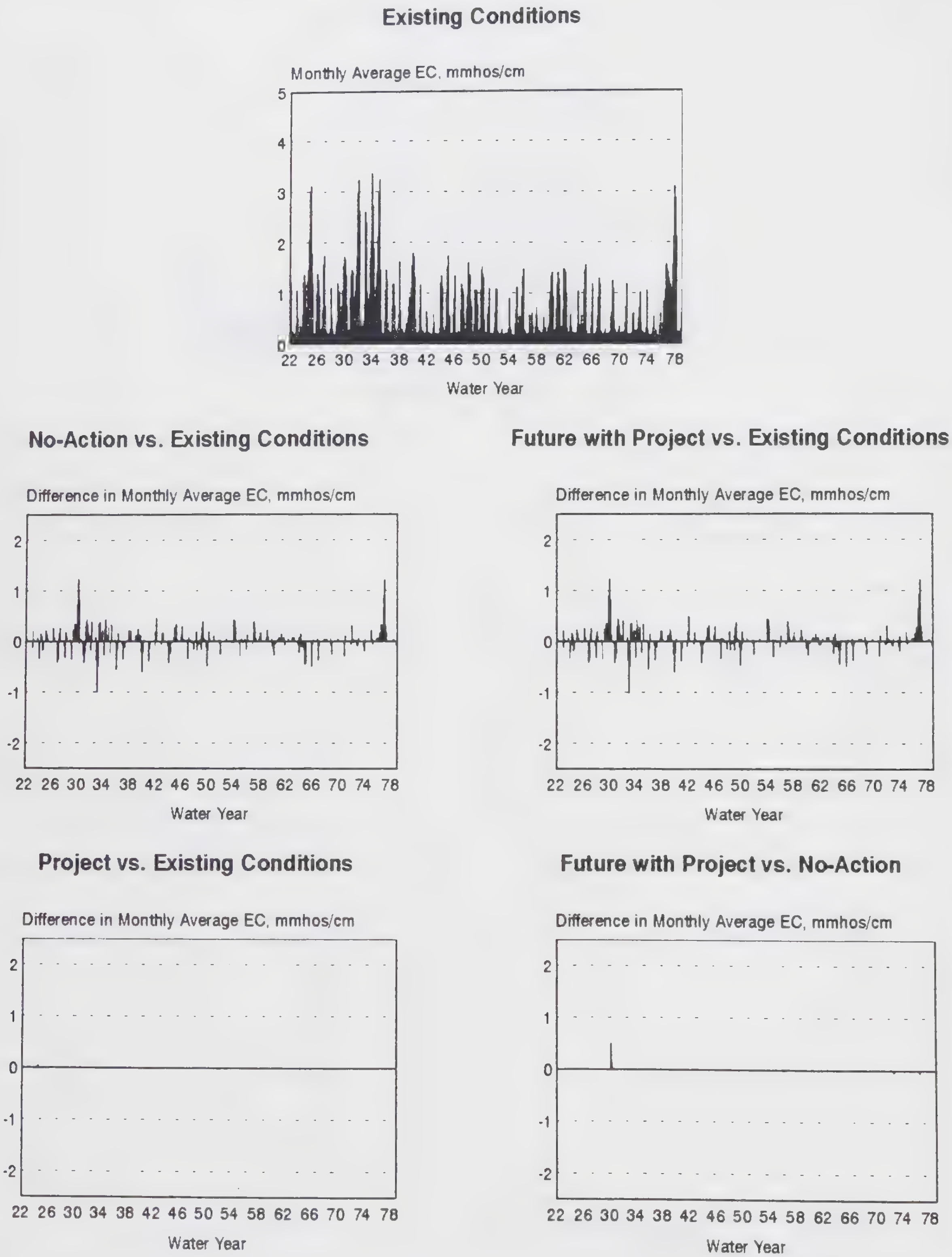


Figure 5-6. Estimated Salinity Impacts
San Joaquin River at Jersey Point
Rock Slough/Old River Configuration

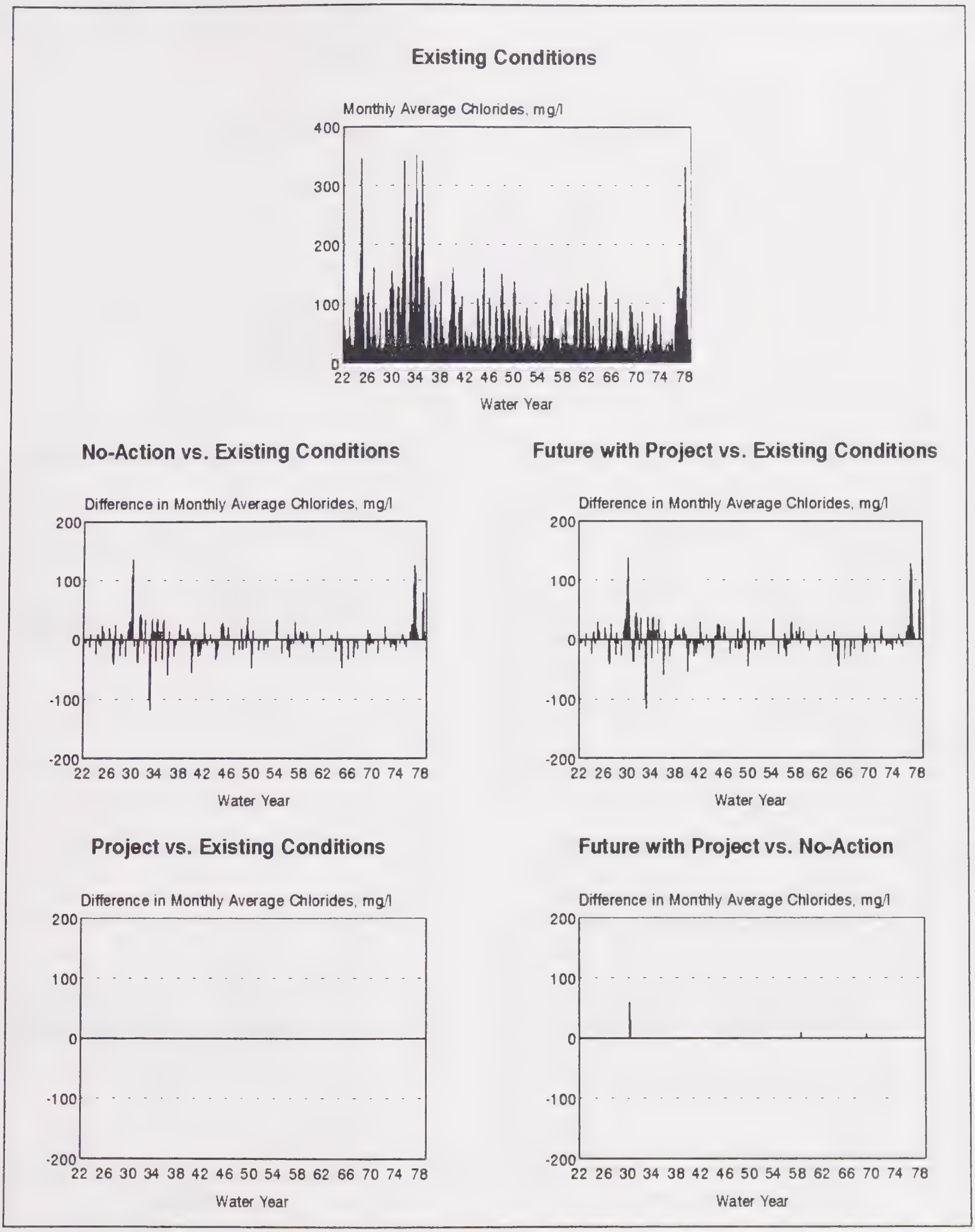


Figure 5-7. Estimated Salinity Impacts
Old River at Rock Slough
Rock Slough/Old River Configuration

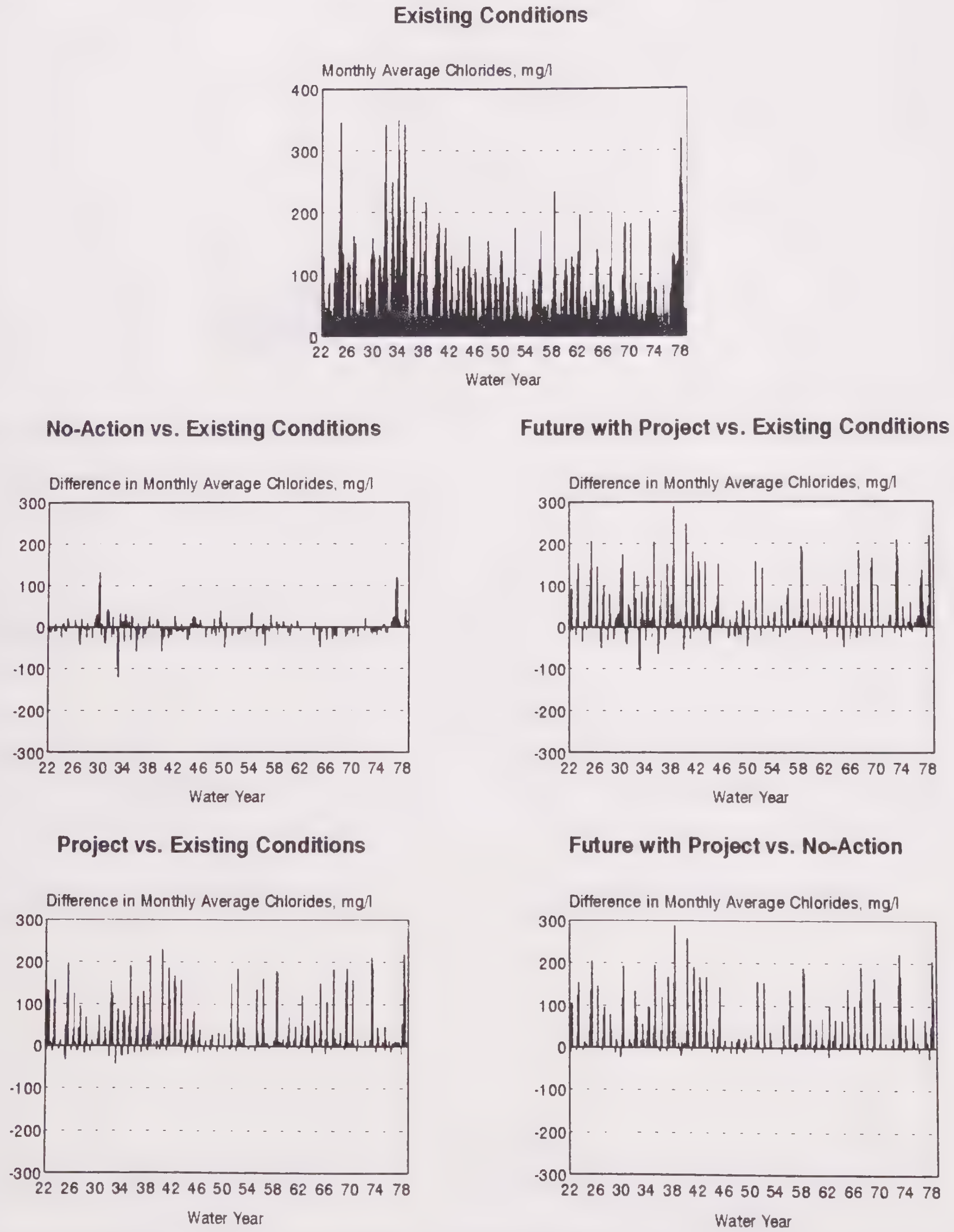


Figure 5-8. Estimated Salinity Impacts
Contra Costa Canal at Pumping Plant No. 1
Rock Slough/Old River Configuration

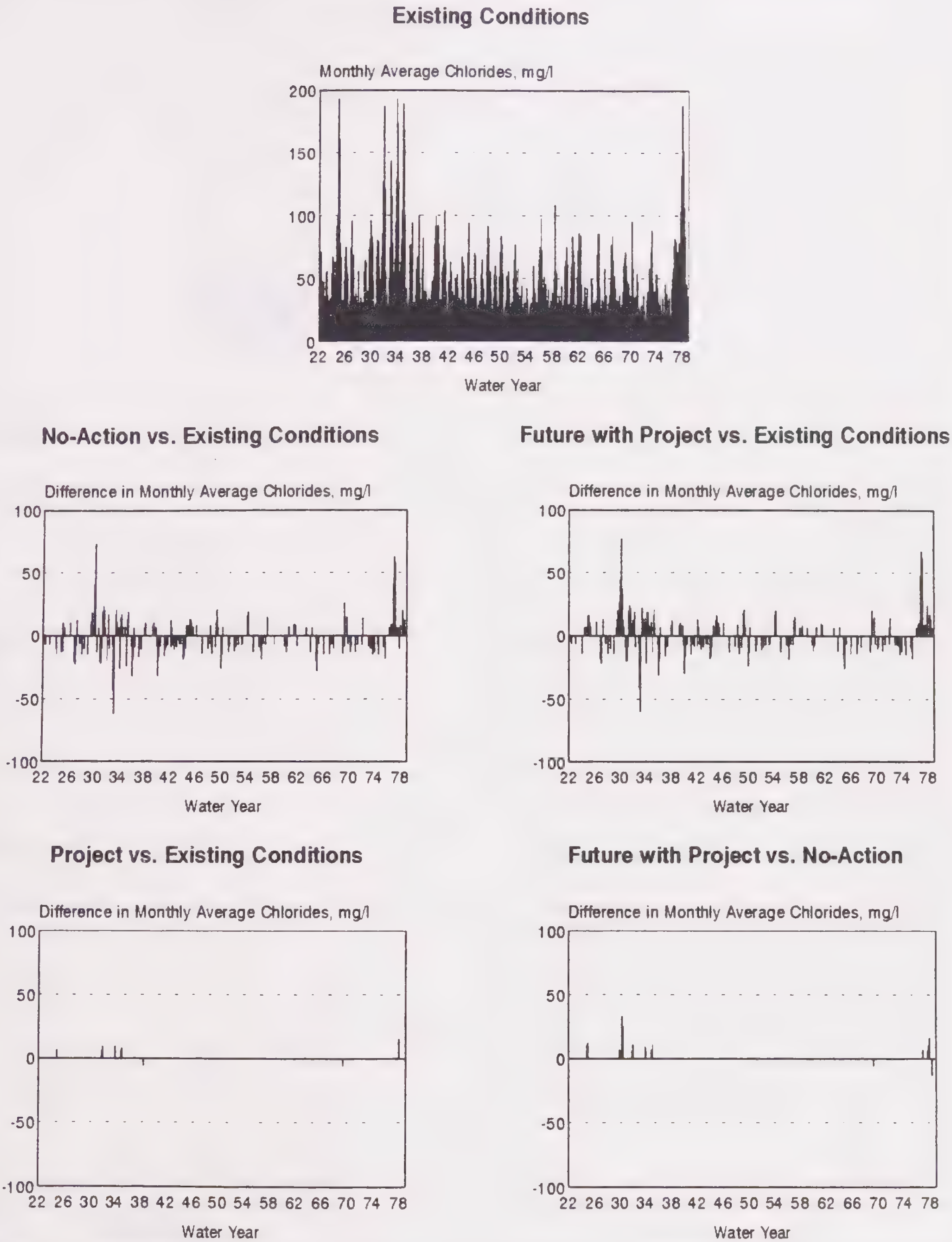


Figure 5-9. Estimated Salinity Impacts
Old River at Highway 4
Rock Slough/Old River Configuration

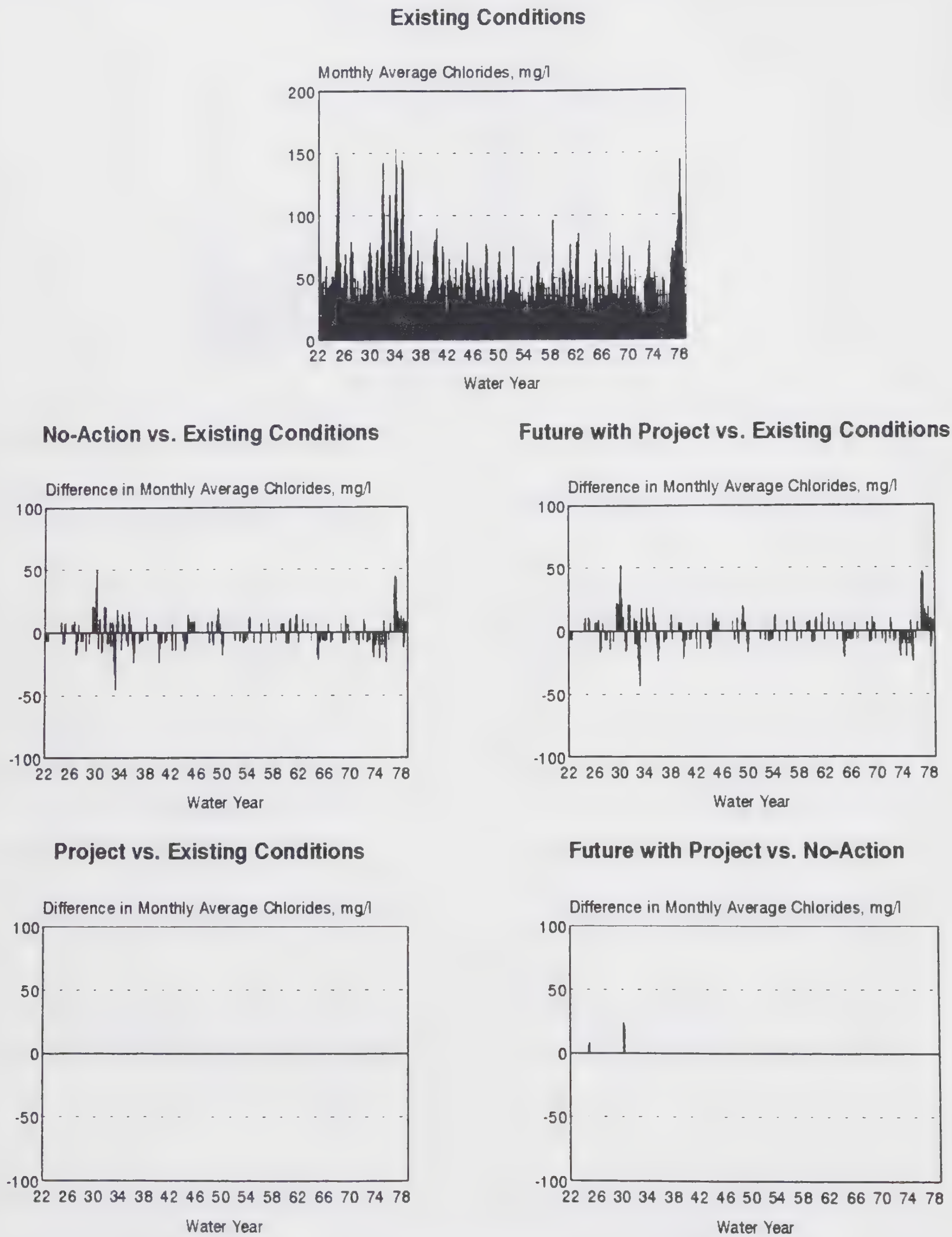


Figure 5-10. Estimated Salinity Impacts
Clifton Court Forebay
Rock Slough/Old River Configuration

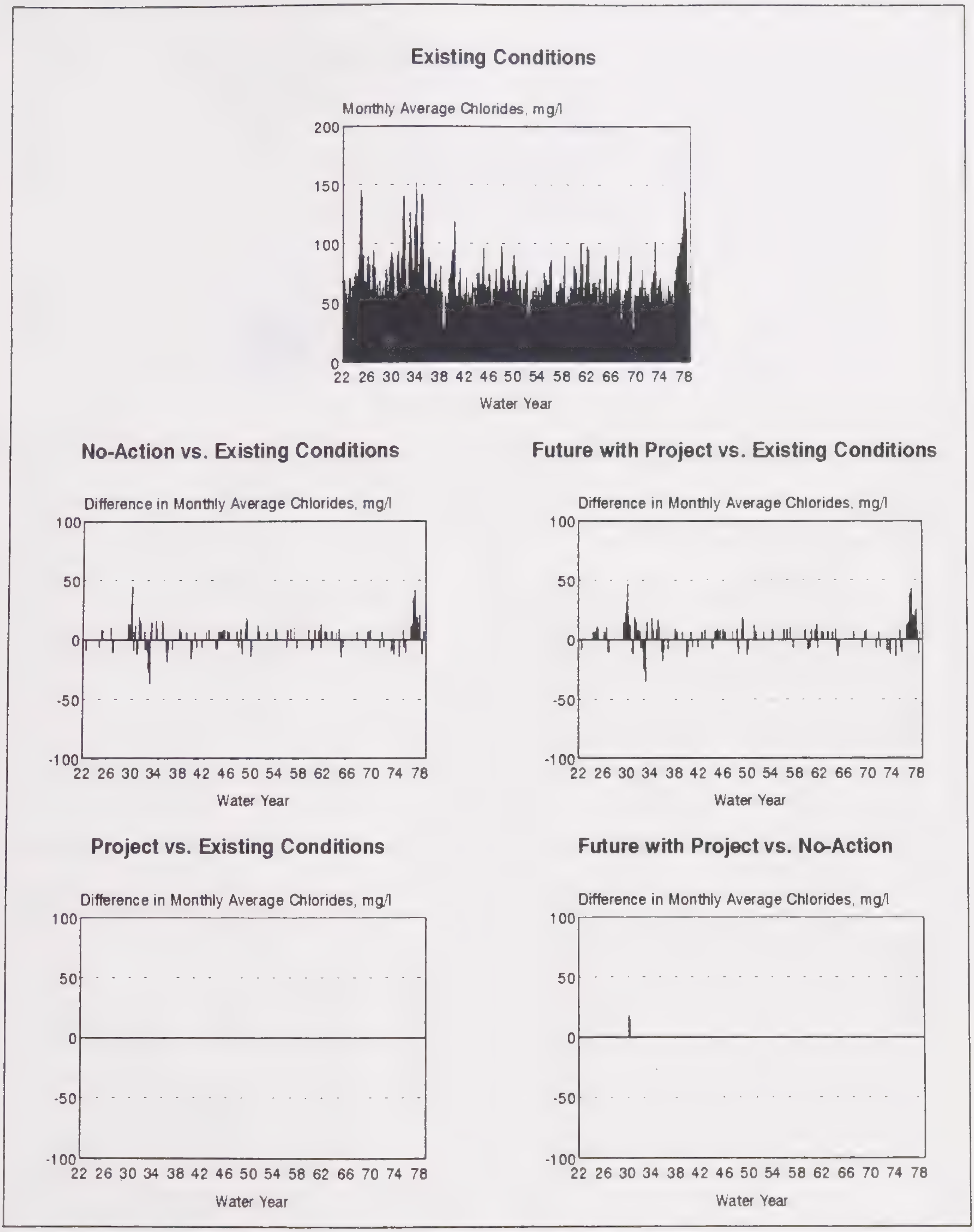


Figure 5-11. Estimated Salinity Impacts
Tracy Pumping Plant
Rock Slough/Old River Configuration

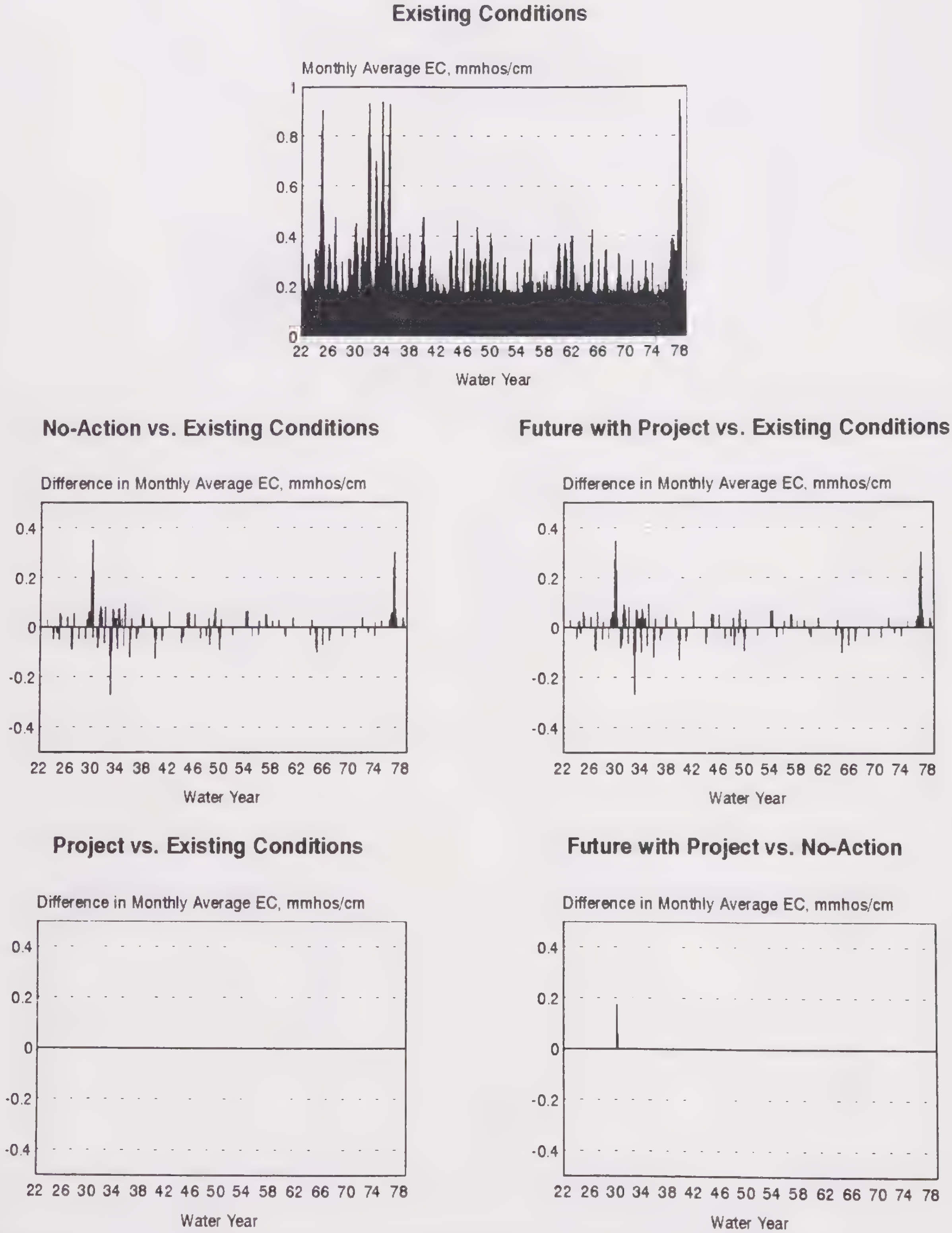


Figure 5-12. Estimated Salinity Impacts
San Andreas Landing
Rock Slough/Old River Configuration

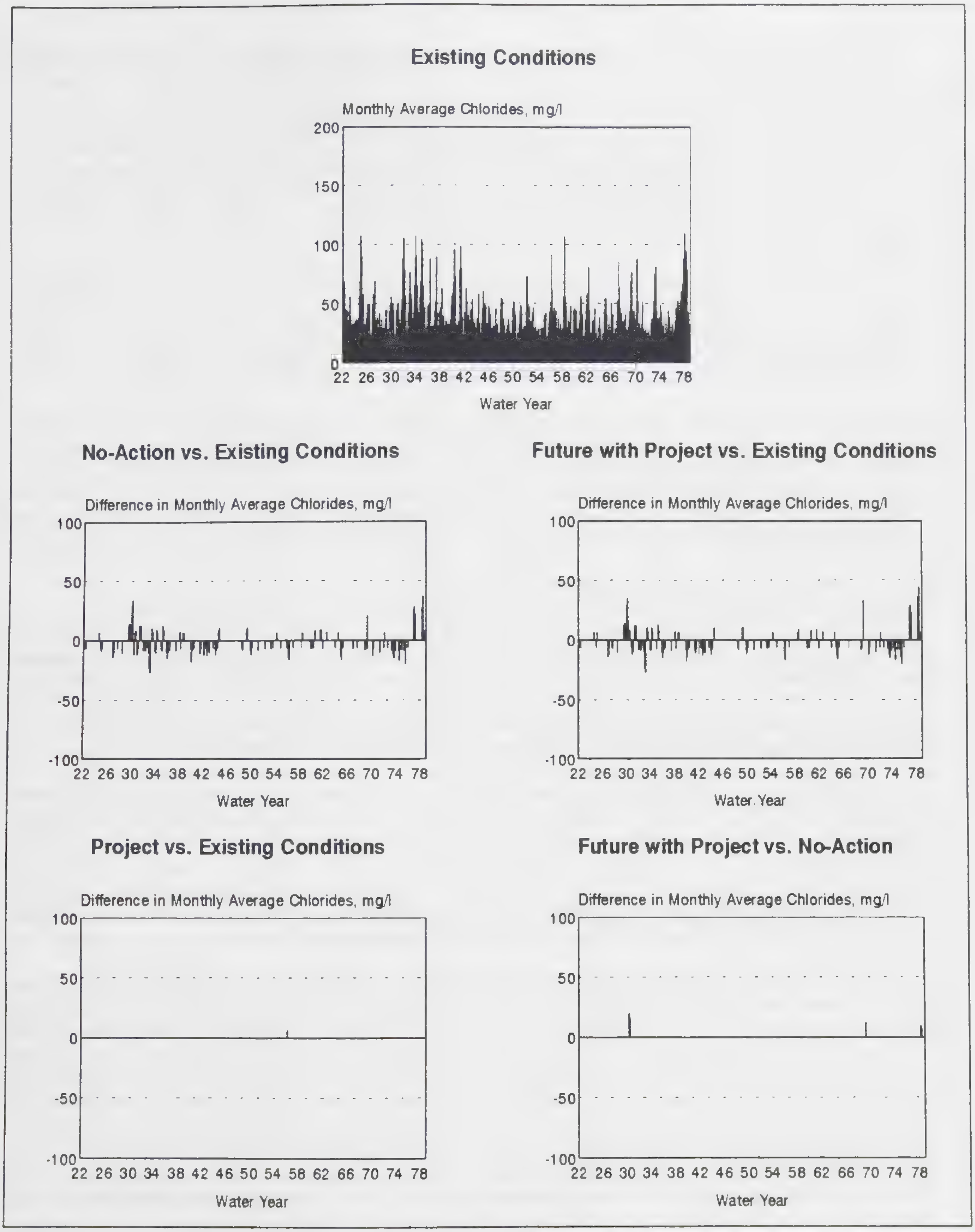


Figure 5-13. Estimated Salinity Impacts
Middle River at Woodward Island
Rock Slough/Old River Configuration

The impacts would be less than significant because most are small, local in nature, and relatively infrequent.

Significant changes at Rock Slough at Contra Costa Canal from the base case were found for this alternative. Salinities are projected to increase approximately 34% of the time. Like the small changes found at Old River at Highway 4, these increases result in part from the change in location of diversions. Two types of events, when combined with the change in diversion location, result in the significant increases. One is related to wet weather conditions and agricultural return flows and the other is related to dry period salinity intrusion.

Agricultural drainage is discharged into Rock Slough. Under existing conditions, the CCWD diversion at the end of Rock Slough results in a net westerly flow; the drainage into Rock Slough moves with the flow and is mostly diverted at the CCWD intake. When CCWD diversions are greatly reduced or stopped in Rock Slough, the drainage continues and can accumulate because only tidal action is occurring. During wet periods and periods of agricultural leaching, the drainage can be large and have high salinity.

Most of the salinity increases calculated in Rock Slough are caused by this action. CCWD diversions at Rock Slough are reduced, and the model shows the accumulation of drainage. The FDM incorporates agricultural drainage in a general way, and model verification results indicate that the model tends to overestimate drainage effects under wet weather conditions, especially at this location. Therefore, the actual levels at this location may be lower. However, based on salinity levels in drainage water and the expected flows, this type of phenomenon would be expected under this alternative.

Although local, this type of increase is frequent and large, and would be a significant impact.

The second type of salinity increase is associated with dry periods with high salinity intrusion, and is not related to drainage. During dry periods, CCWD would largely rely on the Los Vaqueros Reservoir and the second intake for its water supply. The Rock Slough intake would have reduced diversions or would not be used. With little or no flow in Rock Slough, the only means for salt to move from Old River to the existing CCWD intake would be by tidal action. Salt would then require a longer period to move in and the channel would require a longer period to be freshened when salinity levels drop in Old River.

When Rock Slough diversions are reduced, there is a tendency for the salinity in Rock Slough to lag behind the salinity in Old River by about 1 month. Thus, the increases in salinity are preceded by decreases when a month-to-month comparison is made. No significant change is found in Old River, so the effect is local.

Although the increases are large, they are associated with decreases. The events are relatively infrequent and are local. They would therefore, be less-than-significant impacts.

Additional Water Quality Issues. There are over 250 agricultural drains that discharge irrigation return water to the Delta and many are along Old River. The location of the Old River No. 5 intake and other intakes would be located downstream of several agricultural discharges, including one that contains treated wastewater from the Discovery Bay residential development. The secondary treated wastewater is first discharged to an irrigation canal and later pumped over a levee to Old River. The discharge is in compliance with effluent limitations set in an NPDES permit administered by the SFRWQCB. Agricultural discharges are not regulated under the NPDES permit program. Water quality in Old River is affected by this discharge and other upstream agricultural discharges that would directly affect the raw water supply for the Los Vaqueros Reservoir Alternative. These discharges would affect water quality at any of the proposed intake locations because of tidal action in Old River. During low tides, streamflows in Old River can be reversed, and diluted wastes can move upstream for short periods.

Although treated wastewaters from the Discovery Bay water treatment plant are in compliance with the effluent limitations in the NPDES permit, Old River water quality is affected in some measure by the

discharge. CCWD is responsible for selecting the best possible raw water supply for this alternative. Selection of the Old River No. 5 intake would not be entirely consistent with CCWD's water quality goals and objectives. Therefore, placement of a municipal water supply intake near a treated sewage discharge would be a significant adverse impact because it could affect the quality of CCWD's raw water supply.

Rock Slough/Clifton Court Forebay Configuration. The results of the studies for this configuration are similar to the Old River at Highway 4 configuration (Table 5-3).

Western Delta Stations. No significant impacts occur at these stations. The increases found when salinity levels exceeded 95% of the D-1485 standard were small (increases less than 10 μmhos/cm) and infrequent. They would not be significant.

Old River and Interior Delta Stations. The results at these stations were similar to those found in the Old River at Highway 4 configuration. No significant impacts were found at any station except Rock Slough.

A few increases in salinity were noted at Old River at Highway 4. The largest increase was 19 mg/l of chlorides and the remainder were, at most, 12 mg/l. These increases are caused by the shift in location of diversions during dry periods, as described previously. The effects were local and were not seen at Old River near Rock Slough nor at Clifton Court Forebay. They reflect the small effect caused by shifting the point of CCWD diversion; the effect is small because the CCWD diversions are small compared to the flow patterns in the region. Because these increases were infrequent, small in magnitude, and local, they would be less-than-significant impacts.

Significant increases were found at Rock Slough. They are caused by the same events described under the Old River at Highway 4 configuration. Increases caused by the discharge of agricultural drainage would be potentially significant impacts because they are frequent and likely to be large, even though they are local.

Changes caused by a shift in timing of the salinity levels would not be significant impacts. Although the increases are large, they are associated with decreases; the events are relatively infrequent and are local.

Delta Water Quality - Future Conditions

The combined water quality effects resulting from operation of CCWD's Los Vaqueros Reservoir Alternative under future water demand conditions are discussed below. This analysis of future conditions does not include Delta channel modifications proposed in DWR's North Delta and South Delta Water Management Programs or new major water storage facilities.

The incremental Delta water quality effects caused by operation of the Los Vaqueros Reservoir Alternative under future conditions are determined by comparing predicted salinity levels with predicted existing conditions salinity levels for various Delta stations.

Table 5-4 provides a summary of estimated salinity effects from the Los Vaqueros Reservoir Alternative at 10 Delta stations under future conditions.

In one month, the operation studies required the closure of the Delta cross channel when it had been open in the base case. The cause was slightly increased Sacramento River inflows that activated the salmon protection provision of D-1485. The closures increased reverse flows and salt transport from the western Delta into the Old River region. Increased salinities were computed at all stations except Emmaton and persisted for 2 or 3 months. The impact would be less than significant, because it is infrequent in these studies, but it does draw attention to complications that may arise when multiple beneficial uses must be protected.

Table 5-3. Summary Statistics for Simulated Effects of Los Vaqueros Reservoir Alternative - Rock Slough/ Clifton Court Forebay Configuration at 10 Delta Locations Compared to Existing Conditions

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases when Base is above 95% of D-1485
Sacramento River at Emmaton	1	<1	0	0	0
San Joaquin River at Jersey Point	0	0	2	<1	4
Old River at Rock Slough	0	0	2	<1	0
Contra Costa Canal Intake	55	8	240	35	7
San Joaquin River at San Andreas	0	0	0	0	0
San Joaquin River at Antioch	0	0	0	0	0
Old River at Highway 4	0	0	0	18	0
Middle River near Woodward Island	0	0	1	<1	0
Clifton Court Forebay	0	0	0	0	0
CVP Tracy Pumping Plant	0	0	0	0	0

Table 5-4. Summary Statistics for Simulated Effects of Los Vaqueros Reservoir Alternative - Rock Slough/ Old River Configurations at 10 Delta Locations Compared to the No-Action Alternative

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	129	19	166	24	0
San Joaquin River at Jersey Point	115	17	181	27	2
Old River at Rock Slough	125	18	135	20	0
Contra Costa Canal Intake	104	15	250	37	8
San Joaquin River at San Andreas	64	9	87	13	0
San Joaquin River at Antioch	146	22	233	34	5
Old River at Highway 4	111	16	114	17	0
Middle River near Woodward Island	103	15	52	8	0
Clifton Court Forebay	125	18	115	17	0
CVP Tracy Pumping Plant	58	9	108	16	

Rock Slough/Old River Configurations. Predicted salinity effects of this alternative under future conditions are provided in Table 5-4 and Figures 5-4 through 5-13. No significant incremental salinity impacts are associated with the Rock Slough/Old River configurations, or any of the project alternatives, when compared to computed salinities of the No-Action Alternative. The same basic salinity trends observed for project alternatives that were compared to existing conditions are expressed in the No-Action Alternative scenario. In a few cases, salinity increases were calculated when the future no-action calculations had levels approaching the D-1485 standards. These increases occurred at Contra Costa Canal (two occurrences), Jersey Point (six occurrences), and Antioch (three occurrences). These increases are similar to those found in the existing conditions scenario. Review of data indicates that these events are isolated, infrequent, and small and, therefore, would be less-than-significant impacts.

Rock Slough/Clifton Court Forebay Configuration. Predicted salinity impacts of this project alternative under future conditions are provided in Table 5-5. The results of these studies are nearly identical to the Rock Slough/Old River configurations. No significant incremental salinity impacts are associated with the Rock Slough/Clifton Court Forebay configuration or any of the project alternatives, when compared to computed salinities under the No-Action Alternative. A few cases of calculated salinity increases exist that approach the D-1485 standard. These increases were found at Contra Costa Canal (two occurrences), Jersey Point (six occurrences), and Antioch (three occurrences). These are the same type of increases observed for the Rock Slough/Old River configuration. Review of data indicates that these events are isolated, infrequent, small, and, therefore, would be less-than-significant impacts.

Additional Water Quality Issues

Rock Slough/Old River No. 5 Configuration. The proposed location of the Old River Intake No. 5 would be downstream of a small treated wastewater discharge from the Discovery Bay residential development. The permitted secondary treated wastewater is discharged to Old River in compliance with effluent limitations in a NPDES administered by SFRWQCB. Although the wastewater discharge meets effluent guidelines in the NPDES permit and is diluted substantially, proposing a municipal water supply intake downstream of the discharge may generate substantial public concern and may be inconsistent with the goals and objectives of the Los Vaqueros Reservoir Alternative. Therefore, because of the high potential for public concern, this impact would be significant.

Kellogg Reservoir Alternative

Construction-related impacts, impacts associated with the relocation of Vasco Road and utility facilities, and Delta water quality impacts of the Kellogg Reservoir Alternative are the same as those described previously for the Los Vaqueros Reservoir Alternative, Rock Slough/Old River configurations, including issues associated with locating the proposed intake near a municipal wastewater discharge.

Desalination/EBMUD Emergency Supply Alternative

Construction-Related Impacts

Impacts related to expansion of the Rock Slough intake channel and pipeline construction would be similar to those described under the Los Vaqueros Reservoir Alternative. These impacts would be significant.

Table 5-5. Summary Statistics for Simulated Effects of Los Vaqueros Reservoir Alternative - Rock Slough/ Clifton Court Forebay Configuration at 10 Delta Locations Compared to the No-Action Alternative

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	128	19	167	24	0
San Joaquin River at Jersey Point	113	17	185	27	2
Old River at Rock Slough	120	18	137	20	0
Contra Costa Canal Intake	103	15	258	38	9
San Joaquin River at San Andreas	61	9	87	13	0
San Joaquin River at Antioch	143	21	236	35	5
Old River at Highway 4	116	17	117	17	0
Middle River near Woodward Island	111	16	50	7	0
Clifton Court Forebay	118	17	109	16	0
CVP Tracy Pumping Plant	54	8	108	16	0

Impacts of Brine Discharge

Implementation of this alternative would require discharges of waste brine, the byproduct of the desalination process, into Suisun Bay. The desalination process can increase salt concentrations in the brine by several fold. For example, chloride concentrations in brine could be almost 486% greater than in the feedwater, as shown in Table 2-3. If initial chloride concentrations in feedwater are about 250 mg/l, after processing through the plant these concentrations would be about 1,215 mg/l in the brine. Similar increases are predicted for other constituents such as sodium, potassium, and other inorganic chemicals. Concentrations of chloride, sodium, and other constituents in brine wastes would decrease when diluted and mixed with water from Suisun Bay. However, even after dilution, resulting salt concentrations would probably exceed basin plan objectives for salinity and specific ions.

Brine waste discharges from the desalination plant to Suisun Bay would be under the jurisdiction of SFRWQCB. SFRWQCB is responsible for protecting the beneficial uses of Suisun Bay through implementation and enforcement of water quality objectives in the basin plan. Beneficial uses of Suisun Bay as stated in the basin plan include industrial service supply, navigation, water contact recreation, commerce, wildlife habitat, fish migration and spawning habitat, rare and endangered species preservation, and estuarine habitat.

The basin plan salinity objective states that "controllable water quality factors shall not increase the total dissolved solids or salinity of waters of the state so as to adversely affect beneficial uses, particularly fish migration and estuarine habitat". In addition, desalination plant discharges would also have to be consistent with effluent limits based on numerical and narrative water quality objectives in SWRCB's Water Quality Control Plan for Enclosed Bays and Estuaries. (California State Water Resources Control Board 1991).

Further water quality modeling of discharges and the effects of dilution and mixing of brine wastes would be required by SFRWQCB before a waste discharge permit could be issued. FDM results discussed earlier cannot be used to predict discharge quality and effects on Suisun Bay because they do not include the disposal of brine.

Comparison of predicted water quality of brine wastes with existing basin plan and bay and estuary plan objectives indicates that discharges would likely exceed numerical limits for certain constituents. Potential exceedence of water quality objectives from brine waste discharges would be a significant adverse impact.

Delta Water Quality - Existing Conditions

This alternative would slightly increase CCWD diversions because of the desalination plant operations. Results are provided in Table 5-6 and the Stage 2 EIR/EIS Technical Report (bound separately).

No significant salinity impacts were identified for this alternative. Only a small number of changes that were not clearly insignificant were found at any station. These changes were all small and infrequent and would be less-than-significant impacts.

A slight decrease in salinity was found in Rock Slough in some months. This decrease was due to the slightly increased level of diversions necessary for this alternative and is the opposite result of that found when diversions in Rock Slough are decreased; in this case, the increased circulation results in greater dilution of the agricultural drainage. This impact would be less than significant.

Table 5-6. Summary Statistics for Simulated Effects of the Desalination/EBMUD Emergency Supply Alternative at 10 Delta Locations Compared to Existing Conditions

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	0	0	0	0	12
San Joaquin River at Jersey Point	0	0	0	0	3
Old River at Rock Slough	0	0	0	0	0
Contra Costa Canal Intake	4	0	0	0	4
San Joaquin River at San Andreas	0	0	0	0	0
San Joaquin River at Antioch	0	0	0	0	6
Old River at Highway 4	0	0	0	0	0
Middle River near Woodward Island	0	0	0	0	0
Clifton Court Forebay	0	0	0	0	0
CVP Tracy Pumping Plant	0	0	0	0	0

Delta Water Quality - Future Conditions

No significant incremental salinity increases are associated with the Desalination/EBMUD Emergency Supply Alternative under future conditions. The effects are the same when compared to the salinity effects under present conditions. The results are provided in Table 5-7 and the Stage 2 EIR/EIS Technical Report (bound separately).

Middle River Intake/EBMUD Emergency Supply Alternative

This alternative would shift the location of the CCWD diversions. The amount diverted would be unchanged, as would the diversion schedule.

Construction-Related Impacts

Impacts related to intake facility and pipeline construction would be similar to those described under the Los Vaqueros Reservoir Alternative. These impacts would be significant.

Delta Water Quality - Existing Conditions

The results are summarized in Table 5-8 and details are given in the Stage 2 EIR/EIS Technical Report (bound separately). As expected, few potentially significant impacts were identified, except local impacts associated with the change in diversion locations. These impacts are discussed below.

Rock Slough. The results found here were similar to those found for the Los Vaqueros Reservoir Alternative. Significant increases were caused by the effects of agricultural drainage and reduced circulation in Rock Slough. Increases caused by discharge of agricultural drainage would be potentially significant impacts because they are frequent and likely to be large, even though they are local.

Changes caused by a shift in timing of the salinity levels would also be less-than-significant impacts. Although the increases are large, they are associated with decreases; the events are relatively infrequent and are local.

Old River at Highway 4 and Clifton Court Forebay. The change in CCWD diversions from Rock Slough to Middle River causes a shift in the general circulation patterns in the area. This in turn caused relatively small increases in salinity in Old River south of Rock Slough. In addition, the shift in location means that CCWD would divert more high-quality water from Middle River and less poor-quality water from Old River during periods of salinity intrusion. The result was a few months with increased salinity levels at Clifton Court Forebay and in Old River at Highway 4.

At Clifton Court Forebay, the maximum increase was 9 mg/l of chlorides. At Old River at Highway 4, the maximum increase was 20 mg/l, with all other increases below 15 mg/l.

The increases tend to be found during dry periods. They are indicative of the effect of shifting the intake, but because the diversion levels involved are small compared to the general flow patterns, the effects are small.

Because most changes are relatively small and fairly local, they would not be significant impacts.

Table 5-7. Summary Statistics for Simulated Effects of the Desalination/EBMUD Emergency Supply Alternative at 10 Delta Locations Compared to the No-Action Alternative

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	129	19	163	24	31
San Joaquin River at Jersey Point	112	16	182	27	2
Old River at Rock Slough	130	19	125	18	0
Contra Costa Canal Intake	176	26	112	16	6
San Joaquin River at San Andreas	64	9	82	12	0
San Joaquin River at Antioch	142	21	233	34	5
Old River at Highway 4	134	20	89	13	0
Middle River near Woodward Island	113	6	49	7	0
Clifton Court Forebay	130	19	100	16	0
CVP Tracy Pumping Plant	59	9	93	14	0

Table 5-8. Summary Statistics for Simulated Effects of the Middle River Intake/EBMUD Emergency Supply Alternative at 10 Delta Locations Compared to Existing Conditions

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	0	0	0	0	3
San Joaquin River at Jersey Point	0	0	0	0	4
Old River at Rock Slough	0	0	1	<1	0
Contra Costa Canal Intake	58	9	317	46	7
San Joaquin River at San Andreas	0	0	0	0	0
San Joaquin River at Antioch	0	0	0	0	5
Old River at Highway 4	0	0	22	3	0
Middle River near Woodward Island	2	<1	1	<1	0
Clifton Court Forebay	0	0	9	1	0
CVP Tracy Pumping Plant	0	0	0	0	0

Delta Water Quality - Future Conditions

Predicted salinity effects of this project alternative under future conditions are provided in Table 5-9 and the Stage 2 EIR/EIS Technical Report (bound separately). No significant incremental salinity effects are associated with the Middle River Intake/EBMUD Emergency Supply Alternative or any of the project alternatives when compared to computed salinities of the No-Action Alternative. The same basic salinity trends observed for the Middle River Intake/EBMUD Emergency Supply Alternative when compared to existing conditions are expressed in the No-Action Alternative scenario. A few cases were found where salinity increases approached the D-1485 standard, including Sacramento River at Emmaton (three occurrences), Contra Costa Canal (ten occurrences), Jersey Point (two occurrences) and Antioch (three occurrences). These increases are the same as those observed under existing conditions. Review of salinity data indicates that these events are isolated, infrequent, and small and, therefore, would be less than significant impacts.

Cumulative Future Conditions

Cumulative water quality impact analyses evaluate the combined effects of future Delta water projects. Potential projects included in the analyses are DWR's North and South Delta Water Management Programs, the Los Banos Grandes Reservoir, the Kern Water Bank, and the privately sponsored Delta Wetlands Project. A brief discussion of each potential future project is provided below.

North Delta Water Management Program

The first phase of the North Delta Water Management Program involves channel improvements to the South Fork of the Mokelumne River. This project is designed to permit increased quantities of diversions at SWP pumps in the south Delta by reducing net flow reversals in the lower San Joaquin River and the western Delta and to reduce flooding on the Mokelumne River.

South Delta Water Management Program

The South Delta Water Management Program is designed to alter water circulation and water quality in the west and south Delta. By expanding Clifton Court Forebay and relocating its intake northward, this program could reduce overall circulation south of the new intake points. The barriers envisioned as part of this program would redistribute agricultural drainage discharges and San Joaquin River inflows reaching the Delta Cross Channel network.

Los Banos Grandes Reservoir Project

The Los Banos Grandes Reservoir project is an offstream storage project that is separate from the South Delta Water Management Program but also depends on facilities developed for this program. Additional surface water and groundwater storage are designed to permit increased exports.

Kern Water Bank

Kern Water Bank is a groundwater storage and replenishment project jointly sponsored by DWR and Kern County Water Agency. The concept of a water bank calls for storing surplus water in wet and above-normal water years in underground aquifers for use at a later date, when drought conditions or water shortages occur.

Table 5-9. Summary Statistics for Predicted Effects of the Middle River Intake/EBMUD Emergency Supply Alternative at 10 Delta Locations Compared to the No-Action Alternative

Delta Location	Total Months with Reduced Salinity	Percent of Total	Total Months with Increased Salinity	Percent of Total	Total Months with Increases When Base is above 95% of D-1485
Sacramento River at Emmaton	128	19	164	24	3
San Joaquin River at Jersey Point	113	17	184	27	2
Old River at Rock Slough	114	17	143	21	0
Contra Costa Canal Intake	94	14	315	10	10
San Joaquin River at San Andreas	65	10	85	12	0
San Joaquin River at Antioch	143	21	230	34	5
Old River at Highway 4	112	16	120	18	0
Middle River near Woodward Island	106	15	53	8	0
Clifton Court Forebay	107	16	118	17	0
CVP Tracy Pumping Plant	52	1	109	16	0

The Kern Water Bank would obtain water from the Delta and transport it to Kern County through the California aqueduct. Water would be released from the aqueduct and conveyed to recharge basins for percolation to groundwater. The Kern Water Bank is projected to increase the dependable supply of the SWP by about 140,000 af.

Delta Wetlands Project

The Delta Wetlands Project would divert water during winter and spring when surplus water is available in the Delta. Approximately 320,000 af of water would be stored on four Delta islands: Bacon Island, Bouldin Island, Holland Tract, and Webb Tract. Siphons would divert water from Old River, False River, Little Potatoe Slough, and the San Joaquin River to storage on the four islands. Water would be stored for several months before being discharged to the Delta Cross Channel network. In fall, the islands would be managed for waterfowl production and recreational uses. The Delta Wetlands Project EIR was completed in December 1990. The final EIR is currently in preparation and will be distributed to the public in early 1992.

Cumulative Future Conditions Impact Assessment Methodology

The following assessment of the four DWR projects and the Delta Wetlands Project discussed above is based on draft EIRs for the projects. Methods used in the draft documents to describe future Delta salinity conditions are different from those used in this report, as are the levels of detail of the analyses. Further, the drafts may be revised substantially before being released as a final document. For these reasons, cumulative impacts of the projects have not been quantitatively assessed. However, qualitative conclusions can be drawn about the impacts of the projects in combination with those of the alternatives considered in this report.

Because the information about operations of the DWR projects and Delta Wetlands Project is preliminary, it has not been possible to draw firm conclusions about their effects on Delta salinity. The discussion of cumulative impacts considers possible impacts of these projects in general terms. It considers potential changes in water resources project operations, Delta flow patterns, and the resulting Delta salinity. Impacts of the projects combined with those of the alternatives discussed in this report are assessed by considering results from the analyses described earlier in the chapter.

Cumulative Future Impact Analysis

The primary purpose of the DWR projects is to facilitate increased diversions from the Delta while operating within a set of legislative, regulatory, and contractual constraints, including those controlling Delta salinity. The projects envision increased reliance on surplus Delta flows, which would be stored south of the Delta for later use. Channel enlargements and possible channel closures will have significant effects on circulation patterns.

For example, the channel enlargements of the North Delta Water Management Program are intended to result in reduced reverse net flows from the western Delta toward the Old River region. The effect could be reduced entrainment of ocean salts in water available in the region. The channel enlargements of the South Delta Water Management Program are intended to cause increased southward flow in Middle River and may reduce flows in Old River, with some increased concentration of agricultural drainage in that area. The barriers of the South Delta Water Management Program are designed to achieve local improvements in water quality in the extreme southeastern part of the Delta. However, they will direct relatively saline San Joaquin River flows elsewhere, potentially causing some water quality degradation. Finally, relocation of the Clifton Court Forebay intake to the north may result in reduced net flows south of the new intake, with some degradation due to agricultural drainage discharges.

These projects would be operated to achieve compliance with salinity requirements similar to those that would be in effect if the projects were not built. The projects are intended to provide greater operational flexibility than the present Delta configuration. For the purposes of this discussion, it is assumed that the future Delta salinity regimen resulting from project construction would be within the range defined by the assumptions made for the analyses of existing conditions and the No-Action Alternative presented above.

Operation of the Delta Wetlands Project in connection with overall Central Valley water resources project operations has not been well defined. The Delta Wetlands Project would depend on diversion of surplus flows, similar to DWR's projects. Delta Wetlands Project diversions would be substantial, depending on the season. Based on material presented in the project's draft EIR, the project may increase ocean salinity intrusion into the interior Delta in general and the Old River region in particular under certain hydrologic conditions. The potential magnitude and frequency of this effect are unknown. However, the project would need to be operated in coordination with other water resources projects within the constraints of the Delta water quality standards and would most likely be within the range of existing conditions and the No-Action Alternative presented above.

Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Rock Slough/Old River Configurations. The DWR projects and the Delta Wetlands Project have the potential to alter the salinity regimen at the intake to the Los Vaqueros Reservoir Alternative. Accordingly, they could affect the diversion schedule to the reservoir, which is sensitive to Delta water quality. The extent of these impacts cannot be determined. However, Delta salinity impacts of the Los Vaqueros Reservoir Alternative would be similar to those described earlier in this chapter. As discussed above under "Future Cumulative Conditions", it is assumed that the Delta salinity regimen would lie within the range defined by existing conditions and the No-Action Alternative. Under cumulative future conditions, salinity impacts of the Los Vaqueros Reservoir Alternative would be less than significant, except in Rock Slough where concentrations of agricultural drainage would increase as circulation due to the present diversion was reduced.

Rock Slough/Clifton Court Forebay Configuration. The cumulative future impacts of this alternative would be similar to those for the Rock Slough/Old River configuration.

Desalination/EBMUD Emergency Supply Alternative. This alternative was analyzed relative to existing conditions and the No-Action Alternative and was found to have less-than-significant impacts. Based on review of the findings, this conclusion is unchanged under cumulative future conditions.

Middle River Intake/EBMUD Emergency Supply Alternative. This alternative has been found to have less-than-significant impacts relative to existing conditions and the No-Action Alternative except in Rock Slough, where reduced diversions would be expected to lead to significant salinity increases. Based on review of these analyses, this conclusion is unchanged under cumulative future conditions. The effects in Rock Slough would be similar to those described for the Los Vaqueros Reservoir Alternative, Rock Slough/Old River configurations.

MITIGATION MEASURES

No-Action Alternative

The analyses presented earlier in this chapter show that when the major projects are operated to satisfy increased demands, modified operations schedules may result in temporal shifts in Delta flows, causing increases and decreases in salinity, primarily due to the changed schedules. In addition, the analyses show significant salinity increases due to reduced Delta flows associated with increasing overall

water demands. Lower flows may be the result of more intensive water project operations or the relaxation of Delta salinity requirements during periods of water supply deficiency.

Regulatory proceedings leading to approval by agencies such as SWRCB, including the preparation of environmental documentation, should routinely include analyses of alternatives that will not lead to significant Delta salinity increases.

Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Construction-Related Impacts

Impacts from Water Conveyance Pipeline Construction

5-1: Implement Soil Erosion and Pollutant Control Measures. Short-term water quality degradation is dependent on precautions taken during the design and construction period. The following is a list of mitigation measures that could be implemented during construction to minimize water quality degradation and reduce construction-related impacts of water conveyance pipelines to less-than-significant levels:

- grade spoil sites to minimize surface erosion;
- cover bare areas with mulches and revegetate all cleared areas with native plant species or species currently naturalized in the immediate project vicinity, especially those areas that could cause significant erosion problems, such as access road cuts and embankments;
- collect and remove possible pollutants, such as sanitary wastes and petroleum products, from the construction sites;
- preserve riparian and wetland vegetation wherever possible;
- prepare a spill prevention and countermeasure plan before project construction;
- dispose of excavated materials away from water sources or drainages; and
- enforce strict onsite handling rules to keep construction and maintenance materials out of drainages and waterways.

Delta Water Quality

Existing and Future Conditions

5-2: Prevent Salinity Increases at Rock Slough. Analyses of these alternatives demonstrate that they have no significant impacts on Delta salinity, except in Rock Slough. At this location, significant salinity increases are projected because the accumulation of agricultural drainage as diversion to the Contra Costa Canal are reduced. These increases can be reduced or eliminated by more stringent application of water quality control laws and regulations for agricultural drainage. Alternatives to be considered should include relocation of drains to avoid significant impacts on beneficial use.

The analyses reveal a second cause of occasional salinity changes in Rock Slough associated with reduced diversions. The ocean salinity intrusion affects the Old River region and the use of Rock Slough is reduced or suspended; the analyses show a time lag between salinity changes in Old River and the

related response in the slough. The delay occurs because tidal exchange at this location, when unassisted by transport caused by pumping, is a relatively slow process. This phenomenon would be expected to result if salinity decreases as well as increases. Although the changes may be relatively large at any time, they would be less than significant overall because they are local, occur only occasionally, and are the result of a lag in salt transport. No mitigation is necessary.

Additional Water Quality Issues

5-3. Conduct Studies to Evaluate Alternative Discharge Locations. Regulation of agricultural discharges is not currently conducted in California, except for certain areas where water quality degradation is directly attributable to agricultural practices. Although agricultural discharges are one of many sources of water quality degradation in Old River, their exact contribution is unknown at this time. Therefore, no measures are proposed here to reduce the potential incremental water quality impacts to municipal raw water supply from agricultural discharges. Mitigation measures to reduce or minimize the potential water quality impacts from the nearby discharge of treated wastewater are proposed because these discharges are regulated and feasible measures and can be implemented with reasonable expectations of success. Therefore, CCWD should initiate consultation with the agency responsible for the waste discharge and investigate the feasibility of moving the location of the wastewater discharge. If the water quality degradation from the municipal wastewater discharge is found to be substantial, CCWD should consider relocating the discharge or undertaking other measures to minimize the degradation.

Desalination/EBMUD Emergency Supply Alternative

Construction-Related Impacts

Impacts of Canal Expansion and Pipeline Construction. Implementing measure 5-1 would reduce impacts to less-than-significant levels.

Impacts from Brine Discharge

5-4: Conduct Modeling Studies to Determine Appropriate Treatment Requirements. If this alternative is selected, CCWD should initiate consultation with SFRWQCB and submit a Report of Waste Discharge application. Subsequent modeling studies should be performed to determine appropriate dilution requirements, aid in design of the plant's wastewater diffuser, and determine if treatment of the brine is required and feasible.

Delta Water Quality

Existing and Future Conditions. The Delta salinity impacts of this alternative, considered individually, would be less than significant, and no specific mitigation is required. However, impacts in combination with future projects would possibly be significant.

The mitigation measures described for the No-Action Alternative also apply to this alternative.

Middle River Intake/EBMUD Emergency Supply Alternative

Construction-Related Impacts

Impacts from Water Conveyance Pipeline Construction. Implementation of measure 5-1 would reduce impacts to less-than-significant levels.

Delta Water Quality

Existing and Future Conditions. The Delta salinity impacts of this alternative, considered individually, would be less than significant, and no specific mitigation is required. However, impacts in combination with future projects would possibly be significant.

The mitigation measures described for the No-Action Alternative also apply to this alternative.

Chapter 6. Kellogg Creek Water Resources and Public Safety

This chapter primarily assesses Kellogg Creek watershed hydrology, water quality, and fisheries. In addition, information is provided on public health and safety issues. This discussion is included because, although a thorough analysis of project-related public health and safety issues was undertaken for this EIR/EIS, only a few significant impacts, related to Kellogg Creek hydrology, would occur. Therefore, public health and safety impacts are included below under "Hydrology".

Because this chapter focuses on issues relevant to the Kellogg Creek watershed, the Desalination/EBMUD Emergency Supply Alternative and Middle River Intake/EBMUD Emergency Supply Alternative are not discussed.

AFFECTED ENVIRONMENT

Hydrology

Flow Regime

The watershed of Kellogg Creek upstream of Camino Diablo encompass 16,650 acres of steep, hilly terrain, of which about 12,000 acres are upstream of the Los Vaqueros dam site. The highest point in the watershed is at an elevation of 2,300 feet near Morgan Territory Road. The Kellogg Creek channel becomes clearly defined near the boundary between Alameda and Contra Costa Counties. From there to Camino Diablo, about 8 miles, the creek flows through a deep, narrow valley. The sides of the valley rise 300-800 feet above the valley floor, which is 400-2,000 feet wide in most areas. Below Camino Diablo, the creek discharges onto an alluvial fan. A small channel on the fan conveys flows an additional 7 miles to the Delta at Discovery Bay.

Flow in Kellogg Creek is intermittent and occurs primarily during the winter rainy season. Gaged streamflow data are available for only a few years. To characterize streamflow under a broader range of climatic conditions, James M. Montgomery, Consulting Engineers (1990c) simulated daily streamflow for the 1921-1990 hydrologic period using EPA's Hydrologic Simulation Program - FORTRAN (HSPF) rainfall-runoff model. The simulation results indicate that there often is no flow at the Los Vaqueros dam site in summer and that winter streamflow typically consists of a small but persistent base flow interrupted by large but brief flow peaks during rainstorms. Based on the HSPF model, there is flow at the dam site only 38% of the time, and flow exceeds 5 cfs only 6% of the time. The simulated annual discharge of the creek for the 1921-1990 period ranged from 10 to 9,640 af and averaged 1,360 af (Table 6-1). Median simulated annual discharge (550 af) is much less than average discharge because the average is strongly influenced by large, infrequent storms. Median discharge is a better estimate of the typical amount of annual discharge than is the average discharge.

Estimated maximum peak flows at the Los Vaqueros dam site and Camino Diablo are shown in Table 6-1. The 100-year peak flow was estimated by the Contra Costa County Flood Control District. The probable maximum flood (PMF) estimates were developed separately using the Corps' HEC1 Flood Hydrology Model (Brouwer pers. comm.). The PMF is the flow that would result from the largest 72-hour rainstorm considered possible. Except for the PMF and 100-year flows, all values in Table 6-1 are from HSPF model results. Some values were estimated by combining HSPF results with flow relations reported in the PMF study.

Table 6-1. Discharge and Flow in Kellogg Creek with and without Los Vaqueros and Kellogg Reservoirs

Flow	Existing Conditions	Los Vaqueros Reservoir (100,000 af)	Kellogg Reservoir
Simulated annual discharge, 1921-1990 (af)			
At Los Vaqueros dam site			
Minimum	10	10	10
Median	620	550	620
Average	1,360	640	1,360
Maximum	9,640	1,930	9,640
At Camino Diablo			
Average	1,870	1,150	700
Maximum peak flow (cfs)			
At Los Vaqueros dam site			
100-year flood	4,050	150	4,050
Probable maximum flood	21,300	2,900	21,300
At Camino Diablo			
100-year flood	4,390	1,560	150
Probable maximum flood	29,500	9,610	4,590
Emergency release (cfs)			
At Los Vaqueros dam site	NA	1,140	NA
At Camino Diablo			
Dry season	NA	1,140	1,140
Dam failure flow (cfs)			
At Los Vaqueros dam site	NA	1,020,000	NA
At Camino Diablo	NA	973,000	694,000
At Discovery Bay	NA	770,000	612,000

Note: NA = not applicable.

Floodplain Areas

On the average, flooding occurs once every 3 years along Kellogg Creek between Camino Diablo and the SR 4 bridge. The minimum channel capacity along this reach ranges from 200 to 1,100 cfs (Blackmer pers. comm.).

The Kellogg Creek 100-year floodplain was delineated by the Federal Emergency Management Agency (FEMA) and is depicted on the flood insurance rate maps for unincorporated Contra Costa County (Figure 6-1) (Federal Emergency Management Agency 1987). The floodplain area south of the Mokelumne Aqueduct and west of Old River covers about 8,130 acres, most of which is used for agriculture. The part of the floodplain area near Discovery Bay, including Orwood Tract, would be flooded by a high-water event in the Delta channels rather than by flow in Kellogg Creek.

Most of the area within the current 100-year floodplain is used for agriculture or open space uses and contains a few scattered rural residences. A 100-year flood in these areas could cause crop damage and result in property damage to rural residential and farm structures. Residential and commercial uses are also found downstream of the Kellogg Creek watershed. Concentrations of downstream populations are located in Byron and Discovery Bay. The City of Brentwood is generally located outside of local flood hazard areas.

Sediment Transport

Estimates of the annual average sediment discharge at the Los Vaqueros dam site range from about 5 to 16 af/yr, although most of the sediment flux occurs in years of exceptionally high rainfall and streamflow (James M. Montgomery, Consulting Engineers 1990b). The sediment is derived from local soils and generally is very fine grained. Local soil types are Brentwood clay loam, San Ysidro loam, Rincon clay loam, Altamont clay, and Altamont-Fontana complex. In most of these soils, 90-100% of the material has a grain size of less than 0.42 millimeter (mm) and more than 80% has a grain size of less than 0.074 mm (U.S. Soil Conservation Service 1977).

Groundwater Conditions

Kellogg Creek is a source of groundwater recharge in the Kellogg Creek watershed and the alluvial fan area. Wells in the vicinity of the creek are used primarily for domestic purposes. Almost all irrigation uses are supplied by imported surface water. Water levels in 21 wells along Kellogg Creek were measured at least once between July 1989 and May 1990 (James M. Montgomery, Consulting Engineers 1990b). No consistent pattern of water-level changes among the wells was detected. Water levels increased during winter in half of the wells and decreased in the other half. The data are insufficient to reveal any relationship between streamflow and groundwater levels.

Dam Safety

Dam safety is regulated by DSOD. All large dams in Contra Costa County have been investigated and many have been strengthened pursuant to DSOD regulations (Contra Costa County Community Development Department 1991).

Section 8589.5 of the California Emergency Services Act authorizes the Office of Emergency Services (OES) to review emergency procedures for evacuation and control of populated areas below dams in the event of dam failure or emergency release and can require that certain measures be adopted by the appropriate local public safety agency.

Water Quality

Kellogg Creek is an ephemeral stream with a watershed composed primarily of bedded ancient marine and nonmarine sedimentary rocks. Dissolved salts in the creek come from the parent material of the creek's watershed. The creek's watershed is primarily undeveloped and portions are used for cattle production and dryland farming. Water quality trends in Kellogg Creek are similar to other creeks that drain the Mt. Diablo range. Water quality in these streams degrades during summer when streamflow declines and evaporation increases and when mineralized groundwater seepage is the source of streamflow. The frequency and magnitude of flow in Kellogg Creek are highly variable. In some dry and critical years, Kellogg Creek does not flow at all, while in wet years it can have flow throughout summer. Streamflow in Kellogg Creek is measured by the Contra Costa County Flood Control District at a gaged site approximately 2.5 miles downstream of the Los Vaqueros dam site. Although streamflows were not recorded recently, historical streamflow records and observations indicate that flows occur primarily during regional storm events or during very wet years when groundwater sustains streamflows during summer.

Information in this section was obtained from a series of reports produced by James M. Montgomery, Consulting Engineers, for CCWD. The following documents were used in this water quality assessment:

- Task 10 Baseline Monitoring FY 89/90 Draft Report (James M. Montgomery, Consulting Engineers 1990a) and

- Task 11 Los Vaqueros Watershed Hydrology and Water Quality Report (James M. Montgomery, Consulting Engineers 1990c).

In March 1989, CCWD established a series of surface water quality monitoring stations on Kellogg Creek to help characterize spatial and temporal variations in water quality conditions. The study's purpose was to characterize water quality conditions in the creek and aid in identifying potential water quality problems in Kellogg Creek.

Because rainfall during the water quality study was minimal, most of the basal flow in Kellogg Creek most likely was derived from groundwater seepage. Results from 20 surface water samples collected from six stations on Kellogg Creek between March 1989 and March 1990 indicate that water quality can be considered fair to poor during that period. These data were collected in 1989 and 1990 during the fourth year of drought in California and represent a worst-case analysis of creek water quality. Kellogg Creek water quality conditions would probably improve under more normal meteorological conditions. However, the data are useful for characterizing water quality conditions during extended dry periods. Despite several water samples that showed certain parameters with concentrations in excess of primary or secondary drinking water quality standards, monitoring conducted to date does not indicate any major problems in terms of health hazards or treatability.

Groundwater quality in the alluvial fan area generally is poor. Samples were collected from five wells during 1989-1990 and analyzed for major ions (James M. Montgomery, Consulting Engineers 1990a). The concentration of dissolved solids was 720-1,600 mg/l and was greater than the secondary maximum contaminant level for drinking water of 500 mg/l. Similarly, two wells were sampled for nitrates and the concentrations (12 and 17 mg/l as nitrogen) exceeded the primary maximum contaminant level of 10 mg/l.

Fisheries

The Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would inundate a portion of Kellogg Creek and several minor intermittent streams. Streamflow in Kellogg Creek is seasonal; therefore, the fishery

Figure 6-1. Areas along Kellogg Creek That Would Be Inundated by a 100-Year Flood under Existing Conditions

in Kellogg Creek is also seasonal. Fish that periodically inhabit the stream include common species as mosquitofish, Sacramento sucker, carp, Sacramento blackfish, hitch, and threespine stickleback.

ENVIRONMENTAL CONSEQUENCES

Hydrology

The effects of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives on Kellogg Creek flows were determined by comparing flow regimes with and without the alternatives. Effects would be identical under existing and future CCWD water demand conditions because downstream releases would not be affected by minor variations in reservoir operations. The flow regime downstream of the reservoirs under normal operating conditions was estimated using the HSPF model. Simulated rainfall runoff upstream of the reservoir site during 1921-1990 was routed through the reservoir using reservoir operation rules and, in the case of spills, a broad-crested weir equation for the spillway (James M. Montgomery, Consulting Engineers 1990c).

The DAMBRK model developed by the National Weather Service was used to simulate the effects of emergency releases and dam failure. DAMBRK is a one-dimensional, dynamic wave model that routes a wave of water (such as would result from dam failure) down a channel of specified geometry. Details of the model and the assumptions used for these simulations were described by James M. Montgomery, Consulting Engineers (1991a, b).

The effects of changes in flow regime on sediment transport in Kellogg Creek were not rigorously simulated. Increases and decreases in peak flows were assumed to create a tendency toward scour and deposition, respectively. The Los Vaqueros and Kellogg Reservoirs were assumed to intercept all sediment flowing into them.

Changes in groundwater recharge along Kellogg Creek were inferred from changes in flow season and inundated areas during peak flows.

Criteria for Conclusions of Significance

Increased in the magnitude or frequency of floodflows resulting from normal reservoir operations would be significant. Decreases in peak flows would also be significant because of their beneficial effect on flooding and because they could alter patterns of sediment erosion and deposition.

Flooding impacts resulting from dam failure or emergency releases would be less than significant because of their extremely low probability of occurring. Furthermore, mitigation for these risks is necessarily included in the project because of existing regulations governing dam construction methods and disaster preparedness plans.

The following discussion provides information about the risk of dam failure and about DSOD regulations and their implementation. These regulations are actively enforced by DWR's DSOD and the State OES.

The potential for dam failure can result from two sources: unsatisfactory design and construction practices; and natural events, such as overtopping of the dam during a flood. Both of these probabilities have an extremely low probability of occurring as explained below.

Modern dams are designed and constructed under stringent and conservative guidelines and criteria. In a recent study in which the risk of failure for all existing dams was studied, the average annual probability of failure for all dams was estimated to be 0.0001 (Whitman 1984). This value includes many older dams that were designed and constructed under much less stringent guidelines and criteria than are modern dams. However, a recent study performed by Woodward-Clyde Consultants indicated that the average annual probability of failure for new embankment dams is approximately 0.000001 (one in 1 million), which is an extremely low level of risk (Woodward-Clyde Consultants 1991).

In addition, in California, the DSOD is responsible for approving the design and monitoring construction of all new dams. All new dams must meet stringent design criteria that cover all possible conditions that could affect the dam, such as earthquakes and flood events, without taking probability factors into account. Therefore, dams are designed to withstand the largest and strongest earthquake that could conceivably affect the dam. Similarly, dams must be able to safely withstand the effect of the largest possible flood that could occur, which is referred to as the probable maximum flood.

Of the few dam failures that have occurred in the past 30 years in the United States, the cause has often been poor design or construction, causing the dam to fail during the initial reservoir filling. With modern design and construction practices, combined with stringent DSOD criteria and review, such an event is extremely unlikely.

Most other dam failures have occurred because of overtopping of the dam during a large flood. The Los Vaqueros dam will be designed to safely pass the probable maximum flood without overtopping the dam. In addition, the design of the dam will likely include enough capacity that the entire probable maximum flood could be stored in the freeboard of the dam (the storage capacity above the spillway crest and below the top of the dam) such that no overtopping could occur even if there were no spillway.

No-Action Alternative

Under the No-Action Alternative, no hydrologic changes would occur in the Kellogg Creek watershed.

Los Vaqueros Reservoir Alternative

Impacts of Vasco Road and Utility Relocations. Several potential hydrologic impacts were identified in the Vasco Road and Utility Relocation Project EIR. All of these impacts related to effects on runoff and local drainage patterns along the roadway and in Brushy Creek. Mitigation measures proposed and adopted by CCWD incorporated runoff detention basins, culverts, and other construction design features and reduced all impacts to less-than-significant levels.

Impacts on Kellogg Creek Flow Regime. Los Vaqueros Reservoir would affect hydrologic processes in Kellogg Creek during normal reservoir operation, during major Kellogg Creek floodflows, and in the event of emergency releases or dam failure.

Normal Reservoir Operation. The proposed release schedule for Los Vaqueros Reservoir calls for releasing water at the rate of natural streamflow entering the reservoir, up to a maximum of 5 cfs. Flows greater than 5 cfs would be retained in storage. During periods when no flow is entering the reservoir, sufficient water will be released to maintain existing perennial pools in the 1-mile reach immediately downstream of the dam. This release would probably not need to exceed 1 or 2 cfs.

The change in annual discharge with a 100,000-af reservoir was estimated using the HSPF model for 1921-1990, assuming the reservoir was in place during that time (James M. Montgomery, Consulting Engineers 1990c). Unless the reservoir is full, it can easily contain large runoff events in the Kellogg Creek

watershed. As a result, the simulated maximum annual discharge at the Los Vaqueros dam site with the reservoir would be decreased by 79% to about 1,930 af. The average annual discharge is decreased by 53% to about 640 af and the median annual discharge is only slightly less than the average annual discharge (550 af). The reservoir would have little effect on the minimum annual discharge because discharge probably would not exceed 5 cfs during dry years.

The Los Vaqueros Reservoir would decrease the magnitude of the 100-year peak flow at the dam site by 95%, even if the reservoir were full. Peak flow under these conditions was calculated using hydraulic routing equations and assuming a 50-foot-wide, broad-crested spillway (Brouwer pers. comm.). The calculations assumed a larger preproject peak flow than is indicated in Table 6-1. For this analysis, the existing 100-year peak flow shown in Table 6-1 was decreased by 95% to yield an estimate of 150 cfs.

At Camino Diablo, the reservoir would have a less substantial effect on the 100-year peak flow because about 1,500 cfs of the flow is derived from runoff below the dam. Adding releases from the dam to local runoff results in an estimated 100-year peak flow at Camino Diablo of 1,560 cfs. This represents 36% of the peak flow without a reservoir. The 10-year peak flow at Camino Diablo would be about 805 cfs, or about 35% of the 10-year peak flow without a reservoir.

Flooding. As discussed above, this alternative would produce substantial flood control benefits between Camino Diablo Road and Discovery Bay. Flooding would still occur along the 5-mile reach between the mouth of Kellogg Creek valley and the SR 4 bridge because the channel capacity along that reach is only 200-1,100 cfs. Nevertheless, the frequency and extent of flooding would be significantly decreased. Flood protection would be a significant beneficial impact of this alternative.

The area that would be inundated during an emergency release for the Los Vaqueros Reservoir was calculated using the DAMBRK model (Blackmer pers. comm.) (Figure 6-2). Populated areas downstream of the Los Vaqueros dam site could be at risk during periods when emergency releases are required. DSOD requires that outlet works on dams be designed to discharge flows equivalent to either 10% of the head of the reservoir in 10 days or the entire head of the reservoir in 100 days, whichever is greater.

The requirement would be enforced only when possible dam failure is imminent. Such cases would include extensive leakage from the dam, cracking of the dam, or sloughing of the dam face. Although this emergency release requirement has been in effect for nearly 20 years, DSOD has never directed that an emergency release be made for any reservoir in California (James M. Montgomery, Consulting Engineers 1991b).

Implementing the required emergency release of 10% of the head of the Los Vaqueros Reservoir would result in a flow of 1,140 cfs. The extent of resulting inundation is shown in Figure 6-2. This figure shows that only the middle, 5-mile-long portion of the Kellogg Creek downstream channel and adjacent land would be subject to flooding. Approximately 1,870 acres and over 50 buildings would be inundated, which is substantially less than the existing 100-year floodplain area of 8,130 acres. This section of Kellogg Creek is unimproved and currently experiences damaging floods about once every 3 years (James M. Montgomery, Consulting Engineers 1991b).

Emergency releases would be increased gradually up to the maximum release rate to minimize possible damage to property or structures. Given this operation, flooding following an emergency release would be similar to rainfall-generated flood events, but the flood duration would be longer.

If an emergency release is required, little threat to human life is anticipated, assuming that sufficient warning is provided to allow for evacuation of residents. Because the reservoir would significantly reduce natural downstream flooding and because the floodplains associated with emergency release flows would still be substantially smaller than the existing 100-year floodplain, the impacts of flooding associated with possible emergency releases would be less than significant. No mitigation is required.

The areas that would be inundated in the unlikely event of dam failure with a full reservoir also were estimated using the DAMBRK model (James M. Montgomery, Consulting Engineers 1991a, b). The DAMBRK model is one dimensional, however, and cannot precisely predict the direction of flow. Between the dam site and the north end of the Kellogg Creek watershed, the flow would certainly follow the valley. The flow path across the alluvial fan is less certain, however. The momentum of the water exiting the valley (973,000 cfs with a mean velocity of 21 fps) could cause the water to follow a path north of the small existing channel. The path used in the analysis was chosen by comparing the deceleration of the floodwave as it spreads out on the alluvial fan with the eastward acceleration caused by the slope of the fan. Although the comparison did not involve detailed momentum calculations, it indicated that Brentwood probably would not be inundated (Figure 6-3).

Based on the flow path and inundated area shown in Figure 6-3, about 19,600 acres west of Old River would be inundated by dam failure with a 100,000-af reservoir. Byron Tract would be flooded, but levees along Old River would not be overtopped. The flooded area is 2.4 times larger than the area that would be inundated in a 100-year flood under existing conditions. The additional inundated area is primarily agricultural fields. However, these impacts would be less than significant because of their extremely small probability of occurring, as described above under "Criteria for Conclusions of Significance".

Groundwater Conditions. The Los Vaqueros dam site is at a narrow part of the valley where bedrock ridges protrude from hills on either side. This constriction decreases the cross-sectional area of alluvial deposits beneath the valley floor and causes groundwater to emerge as flow in Kellogg Creek. Construction of the dam would include installing a subsurface grout curtain beneath the dam foundation to minimize seepage under the dam. This curtain may cut off most of the groundwater seepage that presently sustains the pools. However, the proposed release schedule will provide sufficient flow to maintain the pools.

This alternative could decrease groundwater recharge slightly in the alluvial fan area downstream of Camino Diablo. By retaining flows greater than 5 cfs in storage in the reservoir, this alternative decreases average annual discharge at Camino Diablo from 1,800 to 1,000 af. Although existing water-level data for wells near Kellogg Creek do not clearly indicate the relationship between streamflow and groundwater recharge, small amounts of recharge could come from peak flows that would be decreased or eliminated by the project. A few rural residences in the alluvial fan area depend on groundwater for their municipal and domestic water supply, which may be partially derived from Kellogg Creek recharge. A significant decrease in recharge could decrease the availability of water to these users. Sufficient water will be released from the reservoir to ensure that users are not adversely affected. Thus, any impacts on groundwater recharge are presumed to be less than significant.

Sediment Transport

Normal Reservoir Operation. Immediately downstream of the Los Vaqueros Reservoir, flows in Kellogg Creek would tend to scour the bed and banks of the creek channel to restore the sediment load intercepted by the dam. Because peak flow rates in this reach would be decreased by about 95%, the ability of the creek to erode the creekbed would be greatly reduced. Nevertheless, some scouring probably would occur because the sediments are fine enough to be transported even by small flows. This scouring effect would be highly localized and less than significant because a full sediment load for the small peak flows could be obtained over a short reach of the creek channel.

Farther downstream, the decrease in peak flows in the main creek would decrease the ability of the creek to transport sediment entering the channel from tributary streams. The creek channel would most likely become smaller, and vegetation would grow more densely in and along the channel. This process is likely to dominate channel morphology changes downstream of the first major tributary below the dam, which is an unnamed creek entering from the northwest about 1 mile below the dam. The increase in vegetation and sediment influx would decrease the ability of the creek to convey floodflows. However, this would probably be more than offset by the decrease in floodflows resulting from the Los Vaqueros Reservoir.

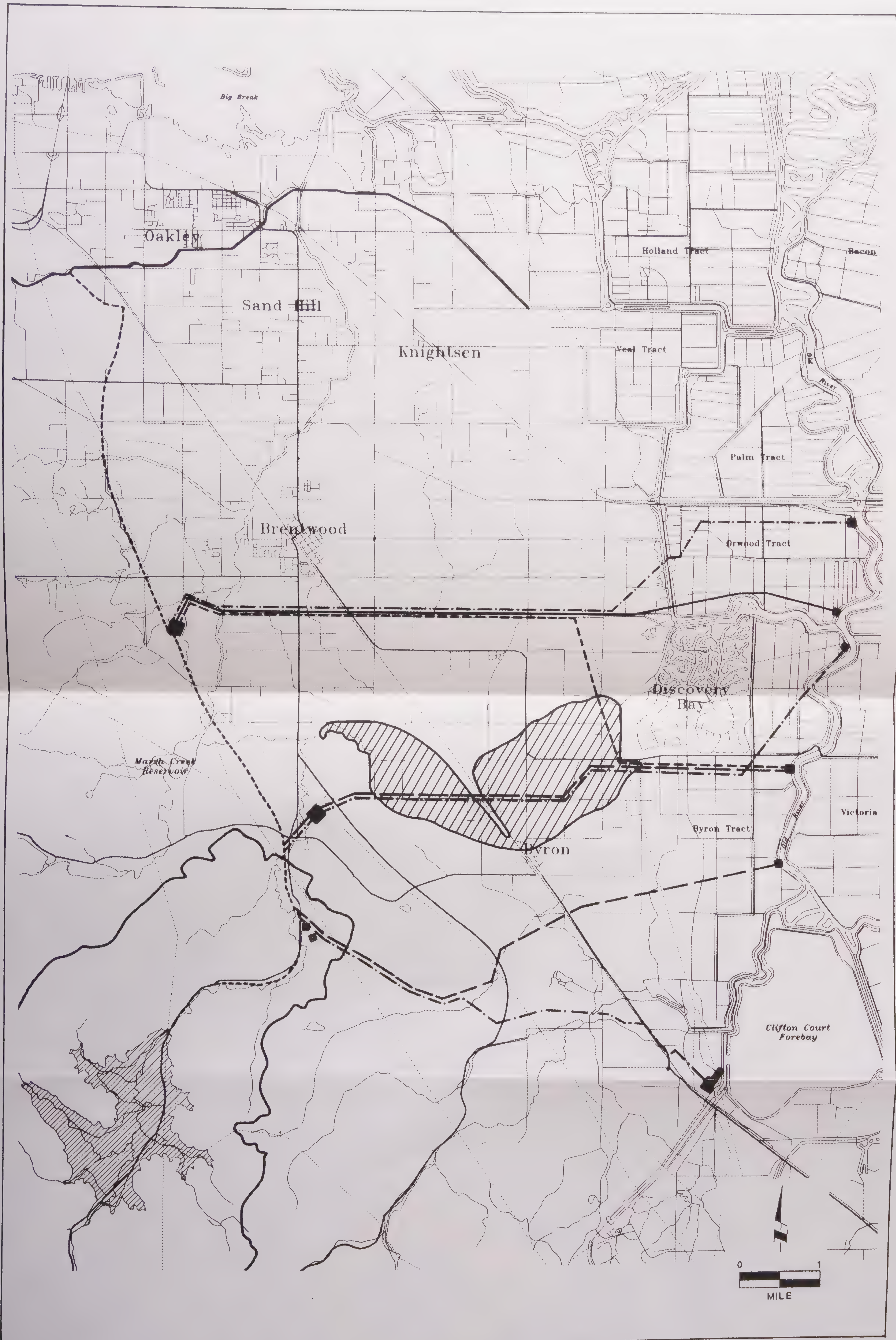


Figure 6-2. Areas along Kellogg Creek That Would be Inundated by Los Vaqueros Emergency Releases.

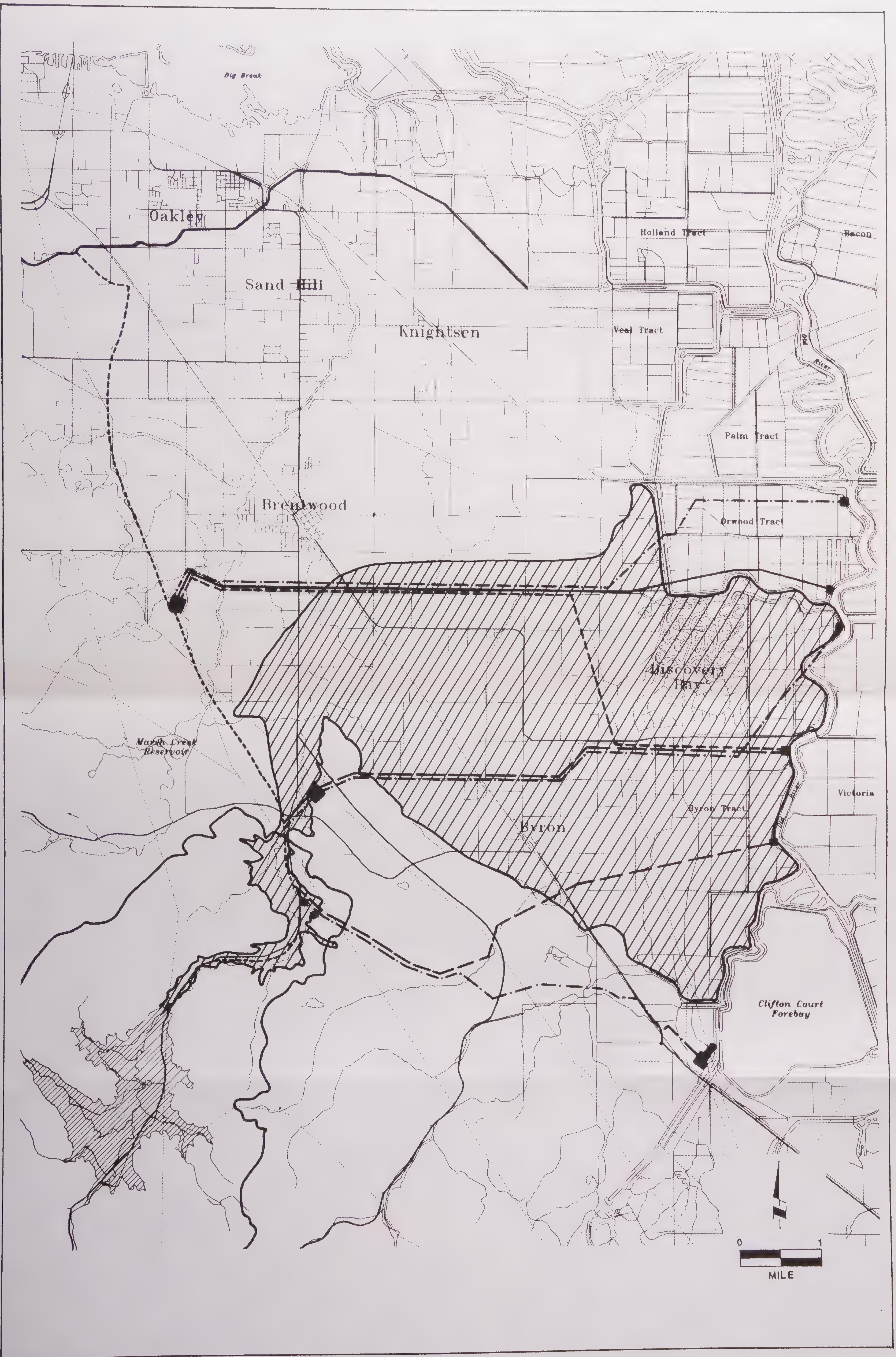


Figure 6-3. Areas West of Old River Inundated by a Los Vaqueros Dam Failure

Also, the changes in channel morphology would affect only land owned and managed by CCWD. Overall, the net impacts on flooding and vegetation resulting from changes in channel morphology would be less than significant.

Kellogg Reservoir Alternative

Flow Regime. The flow regime in Kellogg Creek under the Kellogg Reservoir Alternative is shown in Table 6-1. Although the Kellogg Reservoir would inundate about as much of Kellogg Creek as would the Los Vaqueros Reservoir, the affected area would be smaller because it is located farther downstream. Because this alternative would not affect flows at the Los Vaqueros dam site, only the effects on flow at Camino Diablo are given in Table 6-1.

Normal Reservoir Operation. As with the Los Vaqueros Reservoir Alternative, releases from the dam would equal upstream inflow to the reservoir, up to a maximum of 5 cfs. Higher flows would be retained in the reservoir and differences in the duration and frequency of low flows that would enter each reservoir are unknown but probably would be small. Because peak flows entering the Kellogg Reservoir would be larger, spills might be slightly larger or more frequent. Consequently, average annual discharge below Kellogg Reservoir probably would be slightly larger than annual discharge below the Los Vaqueros Reservoir, or about 700 af/yr.

The 100-year peak flow entering Kellogg Reservoir would approximately equal the 100-year flood at Camino Diablo under existing conditions, or 4,390 cfs. Although this flow is 8% greater than the 100-year peak flow at the Los Vaqueros dam site, Kellogg Reservoir would still contain or attenuate it almost entirely, even if the reservoir were full at the time of the peak flow. The resulting 100-year peak flow at Camino Diablo would be about 150 cfs, which is about 4% of the flow that would occur without Kellogg Reservoir. The PMF would be decreased by 84%, to 4,590 cfs.

Flooding. The Kellogg Reservoir Alternative would nearly eliminate flooding by natural flows in Kellogg Creek between the dam site and Discovery Bay. The 100-year peak flow of 150 cfs could be conveyed by the existing creek channel. The decrease is much larger than for the Los Vaqueros Reservoir Alternative because much more of the watershed is controlled by the dam. Flood protection would be a significant beneficial impact of the project.

The release rate required to decrease the water level in the Kellogg Reservoir by 10% in 10 days would be about 1,110 cfs. This flow is less than the 10-year maximum flow under existing conditions (Blackmer pers. comm.). An emergency release would inundate about as much area downstream of Camino Diablo as under the Los Vaqueros Reservoir Alternative.

The flows resulting from failure of the main dam or one of the nine saddle dams for Kellogg Reservoir were analyzed using the DAMBRK model (James M. Montgomery, Consulting Engineers 1991a). The flood volume resulting from failure of the main dam would be the same as that under the Los Vaqueros Reservoir Alternative because the reservoir volumes are both 100,000 af. However, the height of the dam at Kellogg Reservoir is smaller, so peak discharge would be smaller. Peak discharge at the main dam would be 694,000 cfs, or 71% of the discharge at Camino Diablo that would result from failure of the Los Vaqueros dam. Peak discharge at Discovery Bay would be 612,000 cfs. Failure of the two largest saddle dams would result in peak flows of 176,000 and 75,700 cfs, respectively.

Areas that would be inundated as a result of failure of the main dam or one of the saddle dams for Kellogg Reservoir are shown in Figure 6-4. Failure of the main dam would inundate approximately the same area as would be inundated by failure of the Los Vaqueros dam. Failure of the largest saddle dam (S-3 on the western side of the reservoir) would flood a 1- to 2-mile-wide swath along Marsh Creek that would include Brentwood. Some of the water would flow east from the point where Marsh Creek enters the alluvial fan and would inundate almost as much area southeast of Brentwood as would failure of the main dam.

Failure of the second largest saddle dam (S-9 on the east side of the reservoir) would flood a small unnamed creek drainage north of Brushy Creek. The floodwaters would avoid developed areas along SR 4 but would inundate most of Byron Tract (possibly including part of Discovery Bay). Failure of one of the other saddle dams would inundate approximately the same area as S-3 or S-9, depending on which side of the reservoir the dam is on. These impacts would be less than significant because of their extremely low probability of occurring, as described above under "Criteria for Conclusions of Significance".

Sediment Transport. The Kellogg Reservoir would intercept all sediment entering the reservoir, which would create a tendency for scouring of the Kellogg Creek channel downstream of the reservoir; flows, however, would be so greatly diminished that effect would be very small. No tributary streams of any appreciable size enter Kellogg Creek downstream of the dam site, so local sediment influx into the channel probably would be minimal. Under normal reservoir operation, little erosion or deposition would occur along the channel and, except for encroachment by vegetation, the channel would remain largely unchanged.

Groundwater Conditions. Potential impacts under this alternative are identical to those described above for the Los Vaqueros Reservoir Alternative and would be less than significant.

Water Quality

Criteria for Conclusions of Significance

Impacts on Kellogg Creek water quality are considered significant if implementation of an alternative caused substantial reductions in Kellogg Creek water quality. Impacts on reservoir water quality are considered significant if negative water quality parameters in CCWD's water supply could be increased by implementation of an alternative.

No-Action Alternative

Kellogg Creek water quality would remain unchanged under the No-Action Alternative. No impacts would result.

Los Vaqueros Reservoir Alternative

Construction-Related Impacts

Vasco Road and Utility Relocations. This analysis incorporates, by reference, the water quality impact analysis and findings from the Vasco Road and Utility Relocation Project EIR. The following description is a synopsis of the water quality impacts from that project.

Significant water quality impacts identified in the EIR were identical for the road, electric transmission line, natural gas pipeline, and petroleum pipeline relocation alternatives. These impacts relate to increased erosion during construction and the transport of soils to local waterways. The impacts were considered significant and could be mitigated to less-than-significant levels through implementation of soil erosion and pollutant control measures adopted by CCWD.

Kellogg Creek Water Quality. Construction of the dam for the Los Vaqueros Reservoir is not expected to have significant impacts on Kellogg Creek water quality. CCWD proposes to install a temporary pipe to divert the creek around the construction area and convey water back into the creek downstream of the construction area. A small portion of the creek would be dewatered where the dam would be constructed.

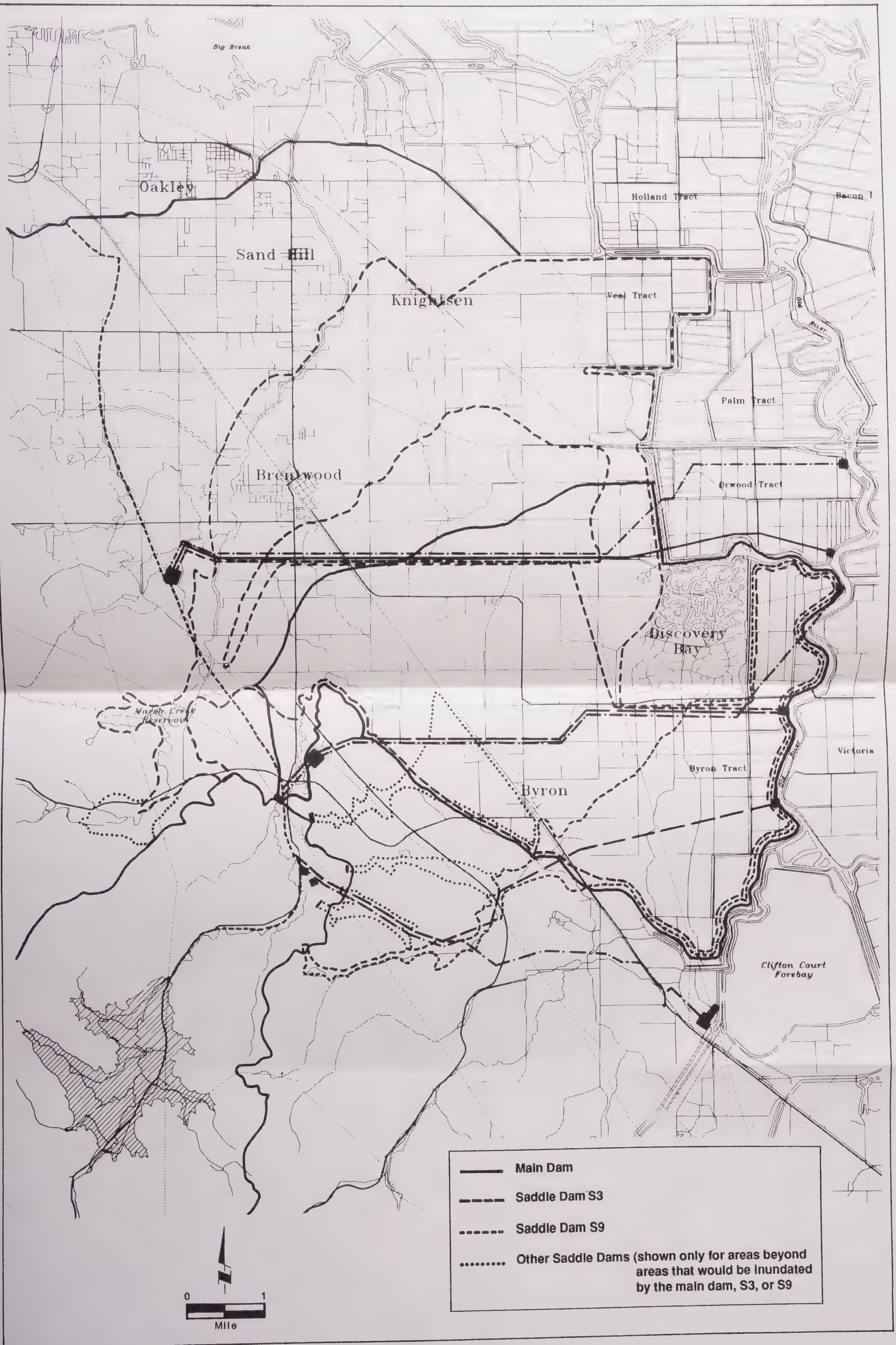


Figure 6-4. Areas That Would Be Inundated by Kellogg Main Dam or Saddle Dam Failure

Los Vaqueros Reservoir Water Quality

The LVOPS was used to estimate seasonal and yearly salinity concentrations in the Los Vaqueros Reservoir on a defined fill-and-withdrawal schedule. Nutrient availability, algae production, and eutrophication information were obtained from studies conducted by Systech Engineers (1991).

The Los Vaqueros Reservoir would store low-mineral-content, nutrient-rich Delta water for subsequent treatment at the Bollman and Randall-Bold Water Treatment Plants. Water diversions from the Delta would typically occur when salt concentrations are low and water quality is good. Once the water is diverted and stored in the reservoir, water quality conditions may change because of thermal stratification, algae production, and other processes.

This section describes the predicted trends in salinity for the reservoir based on LVOPS model results and potential changes in water quality from storage in Los Vaqueros Reservoir. This section also describes potential changes in Kellogg Creek's water quality from Los Vaqueros Reservoir releases.

Simulated Salinity Levels for the Los Vaqueros Reservoir. As shown in Figure 6-5, water stored in the reservoir meets CCWD's chloride objective of 65 mg/l. The plot shows the predicted chloride content of reservoir water with intakes on Old River and at Clifton Court Forebay. Monthly average chlorides are predicted to be marginally higher with an intake at Clifton Court Forebay. Chloride concentrations of up to 62 mg/l for both intake locations predicted during the 1928-1934 extended drought are the result of decreasing lake levels because of increased reliance on Los Vaqueros Reservoir water and increased salt concentrations from evaporation.

Los Vaqueros Reservoir Predicted Water Quality. The following reservoir quality impact assessment is based on a review of reservoir water quality predictions included in the Task 10 water quality report (James M. Montgomery, Consulting Engineers 1990b).

The reservoir quality impact assessment focuses primarily on changes in primary production in the reservoir and subsequent effects on THM formation potential, salinity, and taste and odor problems. The following discussion describes predicted water quality variations in the Los Vaqueros Reservoir.

Prediction of reservoir water quality and algal production can be conducted through a variety of predictive numerical models. These models are based on known relationships between available nutrients and algae requirements for growth and reproduction. The use of numerical models for predicting algal dynamics in water supply reservoirs provides insight on algae production and potential reservoir water quality problems. However, there are many facets of algal dynamics, such as the magnitude of planktonic grazing, shading factors, and influences by algal disease losses that are difficult to predict and that can have profound effects on actual algal production.

Preliminary engineering estimates are based on reservoir morphology, source water chemistry, and other limnological variables. These estimates suggest that the Los Vaqueros Reservoir will stratify during spring and summer, becoming a nutrient-rich reservoir likely to produce populations of blue-green algae as a potential dominant phytoplankton and exhibiting water quality trends similar to other reservoirs in the San Francisco Bay Area.

Excessive algal growth caused by an availability of dissolved phosphorous and nitrogen can create seasonal water treatment problems. Algae can be entrained in the water treatment system, clogging water filters and causing taste and odor problems during the water disinfection process. Several local municipal water purveyors have reported that seasonal algae blooms in water supply reservoirs have caused periodic temporary taste and odor problems. Additionally, extensive floating algal mats may also inhibit recreational use of a reservoir, including boat use, because of the accumulation of decomposing algae along the reservoir shoreline.

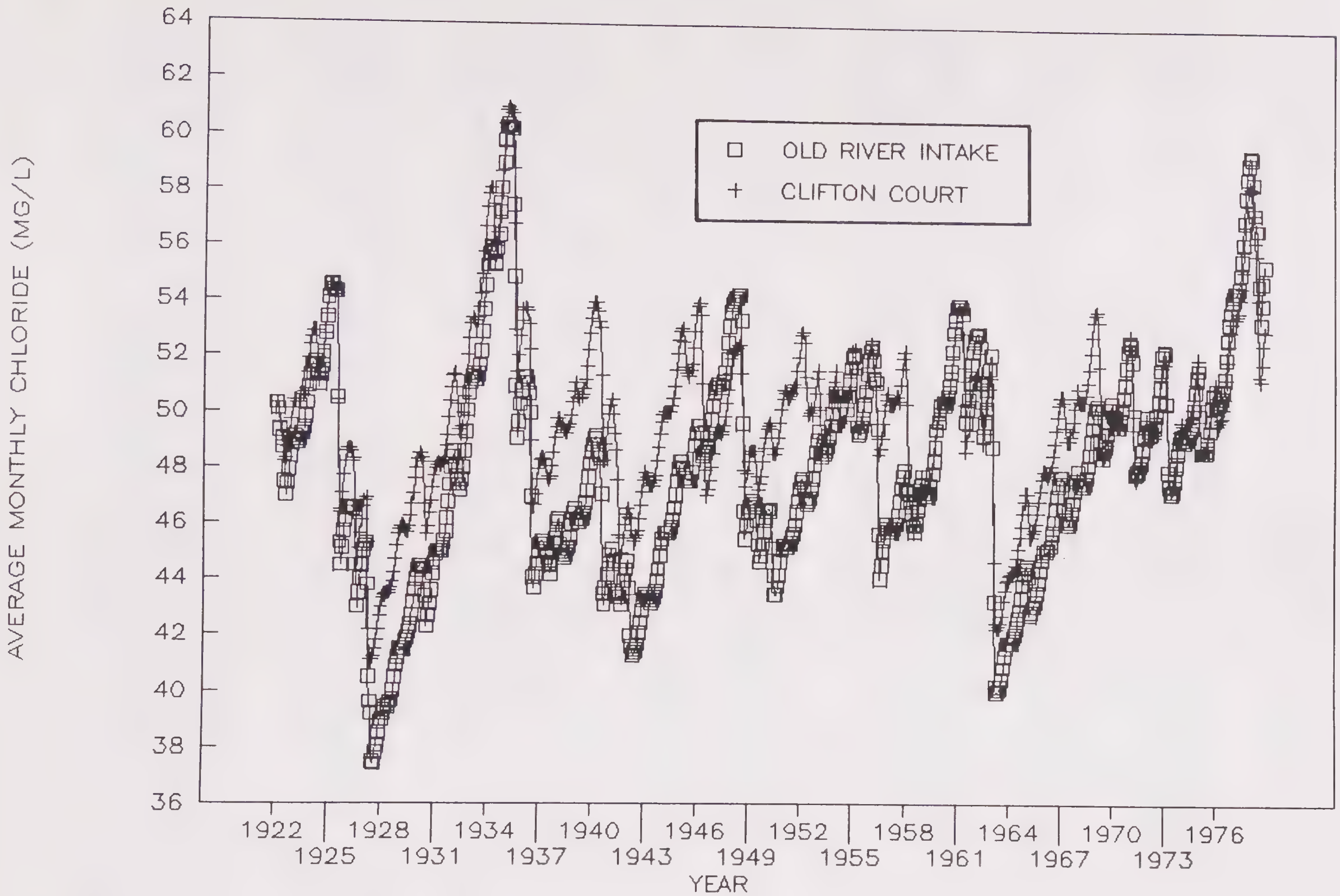


Figure 6-5. Los Vaqueros Reservoir - Simulated Average Monthly Chlorides

Blue-green algae production in Los Vaqueros and Kellogg Reservoirs and subsequent entrainment to the Randall-Bold Water Treatment Plant could contribute to existing adverse taste and odor problems in treated water. Entrainment of algae produced in Delta channels has historically created a seasonal operational problem for CCWD. Algae production in Los Vaqueros Reservoir could potentially increase the frequency and duration of existing operational problems and taste and odor problems in delivered waters.

Entrainment of algae could be reduced by determining an appropriate elevation for the intake structure. The exact elevation of the reservoir intake has not been determined; generalized descriptions of the intake structure are provided in Chapter 2, "Alternatives Including the Proposed Action". Excessive algae production in Los Vaqueros Reservoir and entrainment in the system would be a significant adverse impact because it would contribute to an existing seasonal water treatment problem for CCWD.

The recent closure of Contra Loma Reservoir to human use because of high coliform bacteria counts has caused CCWD to become concerned that operation of existing and proposed landfills may cause similar problems for the Los Vaqueros Reservoir. Fecal contamination by roosting gulls that feed at local landfills is suspected of causing the elevated levels of coliform bacteria at Contra Loma Reservoir. Construction of two new landfills at Marsh Creek and Keller Canyon and expansion of the two existing landfills (Vasco Road and Altamont Pass Sanitary Landfills) near the Los Vaqueros Reservoir have caused CCWD to become concerned about potential water quality effects from the roosting water birds. The Los Vaqueros Reservoir site lies beneath a direct flight path between the proposed Marsh Canyon Landfill and the existing Vasco Road Landfill. Concern has been raised regarding the potential public health and water quality implications of possible fecal contamination of water supplies from birds that feed at sanitary landfills.

The following findings and conclusions regarding gull use effects on reservoir water quality were summarized from a recent report produced by H. T. Harvey & Associates (1991):

- Field studies of bird use at nearby landfills and reservoirs have shown a strong association between landfills and reservoir use by gulls.

- Sources of coliform bacteria contamination of the Los Vaqueros Reservoir include pathogens present in the Delta from discharges of treated wastewater, urban runoff from upstream cities that discharge into the Sacramento and San Joaquin Rivers, resident livestock and wildlife populations in the Kellogg Creek watershed, and presumed gull use at the reservoir. The Delta water supply would be the largest source of coliform.

- Drinking water quality is expected to be unaffected by bird use even under worst-case scenario conditions.

- Coliform, nitrogen, and phosphorous loading into the reservoir attributable to Delta water supplies, local runoff, and roosting by other waterfowl are expected to be as much as 1,000 times greater than loading produced by gull use.

- Impacts of adsorbed contaminants are expected to be less than significant.

- Under normal operating conditions, reservoir water quality should not be affected by gulls using the reservoir.

- Disinfection practices used by CCWD to treat Delta water supplies are adequate to prevent an increased public health risk from the incremental pathogen load caused by gull feces.

Based on these findings and conclusions, water quality impairment from coliform and pathogen levels resulting from gull use at the reservoir does not appear to be a major issue of concern. CCWD will establish a reservoir water quality monitoring program that will include sampling for coliform bacteria to monitor levels and to assist in evaluating associated human health risks.

Impacts of Los Vaqueros Reservoir on Kellogg Creek Water Quality. Kellogg Creek is an ephemeral stream with a watershed composed of bedded ancient marine and nonmarine sedimentary rocks. As with other creeks in the area, water quality conditions in Kellogg Creek tend to degrade during summer when streamflow declines, evaporation increases, and mineralized groundwater seepage is the primary source of streamflow. The frequency and magnitude of flow in the creek vary considerably. In some years, Kellogg Creek does not have any streamflow, while in other very wet years it can flow throughout summer. Dissolved salts in the creek come from the parent material of the creek's watershed.

Implementation of the Los Vaqueros Reservoir Alternative would improve water quality conditions in Kellogg Creek downstream of the dam. Kellogg Creek water would mix with low mineral content water in the reservoir, which would dilute salt concentrations in Kellogg Creek. For example, the salinity concentrations of water stored in Los Vaqueros Reservoir are substantially lower than existing salinity levels in Kellogg Creek. In a recent study, salinity levels in Kellogg Creek varied from 270 mg/l to a maximum of 2,000 mg/l (James M. Montgomery, Consulting Engineers 1990b); the mean salinity during the study was about 988 mg/l. In contrast, predicted salinity levels in the Los Vaqueros Reservoir would be less than 65 mg/l. Reduction in mineral content would be a beneficial impact.

Impacts of Los Vaqueros Reservoir on Local Groundwater Quality. Some water within the reservoir would percolate into the soil and recharge local groundwater basins. These basins typically contain poor-quality groundwater, as described in the "Affected Environment" section. Groundwater quality may improve over time, as increased inflow to the groundwater basin moves soluble minerals and other water quality constituents away from the reservoir site. Because only small amounts of groundwater are used in the project area and because, in general, quality is not an important consideration for groundwater use, no impacts are expected to occur. No mitigation is required.

Impacts of Marsh Canyon Landfill on Los Vaqueros Reservoir Water Quality. The proposed Marsh Canyon Landfill would be located northwest of the Kellogg Creek watershed approximately 2.5 miles from the Los Vaqueros Reservoir site. During the environmental review process for the landfill, CCWD expressed concerns regarding the potential for impacts on Los Vaqueros Reservoir water quality from groundwater movement, water bird roosting, and windblown litter. On April 18, 1990, CCWD and Waste Management of North America, proponents of the landfill, entered into an agreement that includes groundwater monitoring, litter control, and resolution of problems associated with water birds that may roost on the Los Vaqueros Reservoir. Waste Management of North America is committed to monitoring and resolving water quality impacts that could result from the proximity of the Marsh Canyon Landfill to the Los Vaqueros Reservoir. No impacts would result and no mitigation is required.

Kellogg Reservoir Alternative

Construction-related impacts, impacts associated with the relocation of Vasco Road and utility facilities, and Delta water quality impacts of the Kellogg Reservoir Alternative are the same as those described previously for the Los Vaqueros Reservoir Alternative, Rock Slough/Old River configurations. This section, therefore, focuses on differences in water quality between Los Vaqueros and Kellogg Reservoirs.

Kellogg Reservoir water quality would essentially be the same as Los Vaqueros Reservoir water quality. Both reservoirs would receive nearly identical watershed runoff quality because they both impound Kellogg Creek and its tributaries. Kellogg Reservoir would be slightly larger than the Los Vaqueros Reservoir and receive approximately 40% more local runoff because the dam is located 4 miles downstream of the Los Vaqueros dam site and has more tributary inflow. Although the average depth of the two reservoirs is similar, the shape of the two inundation areas is not. Los Vaqueros Reservoir is relatively compact, with a single dam and three major arms. Kellogg Reservoir would require eight saddle dams and would have two long, shallow arms and several small islands. These differences in shape may affect water circulation and mixing in the shallow arms. Some areas of locally poor water quality could be expected to exist in the arms

of either reservoir. Reservoirs and natural lakes often have shallow areas that exhibit poor circulation and mixing because of lakebed topography. For example, Lake Natoma on the American River and other regional lakes have areas that are a substantial distance from the main flow and currents in the lake. These relatively small, shallow areas allow for substantial heating and evaporation and typically produce conditions conducive to aquatic plant growth.

The impacts of the small pockets of poor water quality predicted for small, isolated arms of Kellogg Reservoir would be less than significant because they should not substantially affect reservoir water quality for municipal or industrial uses.

As described for the Los Vaqueros Reservoir Alternative, no impacts on groundwater quality would result, and no impacts on Kellogg Reservoir water quality from the proposed Marsh Canyon Landfill are anticipated.

Fishery Resources

Criteria for Conclusions of Significance

Impacts on Kellogg Creek fishery resources are not considered significant because the fishery is small, seasonal, and consists of common species. Impacts are considered beneficial if an alternative would provide substantial improvement in fishery habitat conditions.

No-Action Alternative

Under this alternative, Kellogg Creek fishery resources would remain unchanged. No impacts would result. No mitigation is required.

Los Vaqueros Reservoir Alternative

Impacts of Vasco Road and Utility Relocation. The Vasco Road and Utility Relocation Project EIR identified several potentially significant impacts on fisheries resources in Kellogg and Brushy Creeks. Fish habitat could potentially be degraded by physical alteration of habitat at stream crossings and increased sediment input from erosion of disturbed material adjacent to the streams. All impacts were reduced to less-than-significant levels by mitigation measures adopted by CCWD as part of the Vasco Road and utility relocation project and additional mitigation is not required.

Impacts of Reservoir Inundation on Fish Abundance. Although stream and pond habitat would be inundated by the Los Vaqueros Reservoir, the reservoir would greatly increase available habitat for most resident fish species. Fish abundance, particularly for game fish species, such as bluegill, bass, and crappie, would increase in proportion to the amount of aquatic habitat created with reservoir filling. The creation of Los Vaqueros Reservoir would have a significant, long-term, and beneficial impact on fish populations.

Los Vaqueros Reservoir would have a maximum surface area of about 1,450 acres, providing nearshore and open water fisheries habitat. Limnological conditions in the reservoir would favor warmwater species, including largemouth and smallmouth bass, sunfish, striped bass, and catfish. Recruitment of most species into the reservoir would occur through introduction from the Delta and would be maintained by natural production. Striped bass populations would be maintained entirely by larvae entrained in water diverted from the Delta.

The physical living space available for fishes and the diversity and quality of the habitat is usually greatest for reservoirs maintained at near capacity. Maintaining reservoir levels at near capacity typically

provides greater spawning opportunities, cover, habitat diversity, and food availability. Los Vaqueros Reservoir would be filled to near capacity about 50% of the time under existing and future conditions. Except during emergencies, surface area at reduced levels would not be less than 60% of the maximum surface area available at full capacity.

Reservoir drawdown during March-September can have adverse effects on the spawning and rearing success of largemouth bass, smallmouth bass, and sunfish. For most species, a fall in elevation of less than 4 feet in 1 month would not adversely affect spawning success. During 80% of the simulated years, reservoir drawdown for any month during March-September would be less than 4 feet and usually less than 1 foot.

Because the Los Vaqueros Reservoir would be operated to improve water quality and system reliability (rather than to increase yield), it would result in more stable water levels at or near capacity relative to fluctuations in capacity at other reservoirs (e.g., Shasta and Folsom Reservoirs). Fish productivity would likely be higher per unit area relative to other reservoirs and would exceed existing fish productivity in Kellogg Creek by several orders of magnitude.

Abundance of other species currently found in streams in the reservoir inundation area would probably decline. Roach and threespine stickleback are adapted to the existing stream habitat and may not successfully compete with species that thrive in reservoirs. Inundating a portion of Kellogg Creek could have an adverse impact on the local abundance of roach and threespine stickleback. These species are not considered rare, however, and the affected populations would be small. This impact, therefore, would be less than significant.

Kellogg Reservoir Alternative

Kellogg Reservoir would have the same storage capacity as Los Vaqueros Reservoir and would be constructed in the same way. Timing and volume of diversions from the Delta would be the same as under the Los Vaqueros Reservoir Alternative. The effects on fisheries at the reservoir site would be the same as those described for the Los Vaqueros Reservoir Alternative.

MITIGATION MEASURES

Hydrology

No mitigation required.

Water Quality

Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Los Vaqueros Reservoir Water Quality

6-1: Conduct Studies and Design Reservoir Outlet Structure to Allow Operational Flexibility to Manage Water Quality. The evaluation of the reservoir's intake structure is an important consideration in minimizing algae entrainment to CCWD's water treatment plant. A water quality monitoring program and control strategy should be established to monitor reservoir algae production and assist in evaluating various management strategies available to control reservoir algae production.

Chapter 7. Vegetation Resources

AFFECTED ENVIRONMENT

Definitions

Vegetation resources in the project area are categorized as common natural communities, significant natural communities, or special-status plant species to facilitate a discussion of each category's importance, ecological value, legal status (if any), and need for consideration under CEQA or NEPA. Each of these categories is defined below.

Natural Community

A natural community is defined as an assemblage of plants, animals, and other organisms that form a distinct living system with its own composition, structure, environmental relationships, development, and functions (Whittaker 1975).

Common Natural Community. Common natural communities are communities encountered often in a geographic region under similar environmental conditions.

Significant Natural Community. Significant natural communities are natural communities that are uncommon in a geographic region and are important because degrading and destroying them further could threaten populations of dependent plant and wildlife species and significantly reduce regional distribution and viability of the communities. As the number and extent of significant natural communities diminishes, the endangerment status of dependent rare, threatened, or endangered species could become more precarious and currently stable populations of dependent species (i.e., non-special-status species) could become threatened. Loss of significant natural communities could also eliminate or reduce important ecosystem functions, such as water filtration by wetlands and bank stabilization by riparian woodlands.

Significant natural communities are recognized primarily because of their current scarcity compared to historical extent and their importance to dependent species. The degrees of scarcity and threat vary widely between the different significant natural communities; some communities are exceedingly rare and are limited to a few occurrences, while others are more widespread and are represented by a large number of geographically dispersed occurrences. Some significant natural communities already have gained some protection on public lands. When evaluating regional threats of loss of viability, assessing the significance of impacts, or determining the type of mitigation for specific project-related impacts, the number of occurrences of a significant natural community and the degree of protection are important considerations.

Most significant natural communities require special management considerations, but many have demonstrated an ability to withstand or benefit from seemingly incompatible types of management. For example, native bunchgrass communities in the project area have persisted as high-quality stands in spite of over 100 years of livestock grazing in the area. Therefore, a particular community's sensitivity to different types of land use also is an important consideration when evaluating impacts and regional threats.

Wetlands. Wetlands are significant natural communities that deserve special consideration because of historical and current regional and statewide losses and because of the federal and state laws and policies

that pertain to their protection. Wetland communities play a vital role in groundwater recharge, protecting water quality, and providing habitat for dependent wildlife and plant species.

Under Section 404 of the Clean Water Act, the Corps and EPA regulate the placement of dredge or fill material into waters of the United States, which can be divided into jurisdictional wetlands and other waters of the United States. Wetlands are defined for regulatory purposes as:

> areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3, 40 CFR 230.3).

Other Waters of the United States. Other waters of the United States are seasonal or perennial features, such as creeks and stock ponds, that are not considered wetlands because they do not meet one or more of the three mandatory technical criteria of jurisdictional wetlands (i.e., hydrophytic vegetation, hydric soil, and wetland hydrology), as defined by the Federal Interagency Committee for Wetland Delineation (1989).

Special-Status Plant Species

For the purpose of this report, special-status plant species are defined as follows:

- species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.12, various notices in the Federal Register for proposed species);
- species that are Category 1 or 2 candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (55 FR 6184, February 21, 1990);
- species listed or proposed for listing by the State of California as rare, threatened, or endangered under the California Endangered Species Act (14 Cal. Adm. Code 670.5);
- species considered by the California Native Plant Society (CNPS) to be rare, threatened, or endangered in California and elsewhere (Smith and Berg 1988); and
- species that meet the definition of rare or endangered under CEQA.

Regional Setting

The project area encompasses the rolling foothills of the inner South Coast Ranges and adjacent bottom lands of the San Joaquin Valley. The area is noted for its dramatic transitions from the typical grassland, alkali wetland, and Delta marsh communities of the San Joaquin Valley to the foothill environments where grasslands, oak woodlands, and chaparral intermix.

Portions of the project area encompass a strip along the west edge of the San Joaquin Valley from Clifton Court Forebay north to the confluence of the San Joaquin and Sacramento Rivers. The majority of this valley region is developed for agricultural production and is interspersed with small remnants of native biota.

Portions of the project area encompass the inner South Coast Ranges from near Altamont Pass north to Antioch, east of Morgan Territory Road. This area supports a variety of agricultural operations but is largely undeveloped and supports a variety of natural habitats.

Floristic Setting

The project area is located in a zone of biogeographical transition between coastal and interior habitats: lowland grasslands and higher elevation woodland and chaparral habitats, and southern and northern elements of the Coast Ranges flora. The project area supports many of the plant communities that typified vast acreages of the San Joaquin Valley before it was converted to agricultural and urban uses. Of particular regional significance is the presence of mesquite, Palmer's oak, desert buckwheat, and Mormon tea, plants typically associated with the Mojave Desert and arid portions of the southern Coast Ranges. These plants reach their northern range limits in the Los Vaqueros-Corral Hollow area (California Department of Water Resources 1978).

The project area is in an area known for important botanical resources. To the northwest, Mount Diablo State Park supports many special-status plants and is identified as an endemic plant region by Bowerman (1944) and Stebbins and Major (1965). To the north, the Antioch Dunes are a relict example of a historically widespread dune community that was probably scattered throughout the Delta region. Stebbins and Major (1965) and Hoover (1939) identified the region east of the project area as the San Joaquin Valley endemic flora region; this area is noted for its endemic plant taxa, vernal pool and alkali sink scrub vegetation, and for the differentiation and speciation of several plant taxa, such as goldfields (Stout and Wainright 1980) and mousetails (Stone 1959).

The project area contains a large and diverse number of significant natural communities and special-status plant species (Jones & Stokes Associates 1989, 1990; California Department of Fish and Game 1983). The area's transitional location, proximity to noted endemic plant regions, and relatively undeveloped landscape account for the prevalence of noteworthy and important botanical resources.

The project area is in the California floristic province and supports vegetation typical of lowland portions of California that have a Mediterranean climate. Situated along the east base of the Mount Diablo Range, the project area straddles the floor of the San Joaquin Valley and adjacent foothills north to the confluence of the Sacramento and San Joaquin Rivers. The project area encompasses a variety of topoedaphic settings that have a marked influence on the local vegetation.

The project area includes hillsides and uplands with well-drained soils that support annual grasslands and oak woodlands. Scattered sandstone outcrops occur along ridges and steep canyon slopes. A few gently sloping hillsides adjacent to valley bottoms are cultivated for dryland farming.

Valley bottoms are generally flat or gently sloped with alkali soils formed on thick alluvium. Soils are poorly drained because of their high clay content and flat topography, and they support a mosaic of seasonal alkali wetland communities in low-lying areas. Annual grasslands fringe the alkali wetlands and typically occupy higher, well-drained soil inclusions in the valley bottom.

Valley bottoms are traversed by meandering, deeply incised intermittent creeks that have narrow strands of marsh vegetation in the channels and occasional willow or cottonwood trees or small riparian woodlands along the creekbanks.

Previous Biological Studies for the Los Vaqueros Project

Impact analysis and mitigation formulation for this Stage 2 EIR/EIS is based on biological studies conducted from 1988 to 1991. Results of these studies are presented in Results of Biological Resources Inventories and Habitat Evaluations in the Kellogg Creek Watershed (Jones & Stokes Associates 1989) and Results of Supplemental Biological Inventories Conducted for the Los Vaqueros Project in and adjacent to Kellogg Creek Watershed (Jones & Stokes Associates 1991f). The biological studies were conducted to

provide the information needed to assess the impacts of alternative reservoir sites, design mitigation measures, develop management plans for the reservoir watershed, and evaluate impacts of these management activities. Studies focused on plant communities and on threatened, endangered, and other special-status plant and wildlife species in the project area. Both reports contain detailed maps and descriptions of location, size, and vigor of plant communities and special-status species.

Information in the biological inventory reports is supplemented with the delineation of wetlands and waters of the United States for the Los Vaqueros Reservoir inundation area and the relocated segment of Vasco Road (Contra Costa Water District 1990b). The report provides information on the vegetation, soil, and hydrologic setting and delineates the locations and areal extent of waters of the United States, including wetlands.

This chapter also contains previously unreported information on water conveyance alignments and other project features and alternatives considered in this EIR/EIS obtained during spring and summer 1990 and 1991.

Methods

Natural Communities

Natural communities in the project area were identified and classified based on field surveys and interpretation of 1:6,000 color aerial photographs. Community types and boundaries were identified and delineated on aerial photographs during floristic field surveys conducted in spring and summer 1987-1991. Classification was based on a modified version of the scheme developed by DFG (Holland 1986).

The location and extent of wetland impacts of the Los Vaqueros Reservoir and relocated Vasco Road are based on delineation of wetlands and waters of the United States for the Los Vaqueros Reservoir inundation area and the relocated segment of Vasco Road (Contra Costa Water District 1990b). Wetland impact acreage for the Kellogg Reservoir is based on Jones & Stokes Associates (1991g). Wetland acreages presented for other project and alternative features (e.g., water conveyance facilities, desalination facilities, and utility relocations) are based on reconnaissance-level field and aerial photograph surveys. A conservative approach was used for the reconnaissance survey to ensure that all jurisdictional wetlands were considered in the analysis.

Approximately 20 acres of the over 20,000-acre project area remain unsurveyed. The entire Kellogg Creek watershed and Vasco Road realignment corridors have been extensively surveyed for special-status plants, and wetlands have been delineated. Remaining unsurveyed areas are minor (i.e., approximately 5 acres along a portion of the Vasco Road relocation corridor, a portion of the petroleum alignment near Round Valley, and portions of the water conveyance pipelines). Wetland delineations are scheduled for these areas in February 1992, and special-status species surveys will be conducted in March and April 1992.

Special-Status Plant Species

Objectives. The objectives of special-status plant species surveys were to:

- conduct a floristic inventory to identify all vascular plant species in the study area;
- search for special-status plant taxa; and
- map locations, describe habitat association, and estimate the size of special-status species populations in the project area.

Presurvey Investigation. A list of special-status plant species known or suspected to occur in the project area was compiled (see the Stage 2 EIR/EIS Technical Report [separately bound]). This investigation was based on a review of information in Stout and Wainright (1980); Holton and Stout (1982); Booker Holton and Associates (1983); DFG (1983); Jones & Stokes Associates (1986, 1987a, 1989); CNPS (1985); Smith and Berg (1988); Bowerman (1944); EDAW and Wesco (1981); Bartel, Bainbridge, Berg, Bittman, and Townsend (pers. comms.); and a record search of DFG's Natural Diversity Data Base (NDDB) (1991).

Survey Timing. Early spring surveys encompassed low-elevation grassland, alkali wetland, riparian, and oak woodland communities and focused on the following species: large-flowered fiddleneck, San Joaquin spearscale, recurved larkspur, Mount Diablo buckwheat, diamond-petaled California poppy, stinkbells, fragrant fritillaria, Contra Costa goldfields, showy Indian clover, Mount Diablo jewel flower, and caper-fruited tropidocarpum.

Late-spring surveys were conducted in grassland, chaparral, and oak woodland communities above 500 feet elevation and focused on the Mount Diablo and Alameda manzanitas, Mount Diablo buckwheat, diamond-petaled California poppy, Brewer's dwarf flax, Diablo helianthella, Mount Diablo phacelia, and Mount Diablo jewel flower.

Summer surveys were conducted in alkali wetland communities (i.e., alkali grassland, alkali meadow, alkali marsh, valley sink scrub and northern claypan vernal pools) and riparian woodland communities. Special-status plant species targeted for these surveys were hispid and palmate-bracted bird's beaks, San Joaquin spearscale, brittlescale, heartscale, California hibiscus, Colusa grass, and Crampton's tuctoria.

Field Survey Methodology. Jones & Stokes Associates staff conducted field surveys from 1987 to 1991, employing field survey methods recommended by DFG (1984) and Nelson (1987) and approved by USFWS and DFG representatives at a series of prefield scoping meetings (Bartel and Wernette pers. comms.). Known populations of large-flowered fiddleneck, brittlescale, San Joaquin spearscale, hispid bird's beak, palmate-bracted bird's beak, stinkbells, and Brewer's dwarf flax were visited each year before field surveys began to ascertain their phenological status and population condition.

The field surveys were conducted using a floristic method whereby all species encountered were sufficiently identified to ascertain whether they have legal status, qualify as special-status plant species, or deserve special consideration for other reasons. Field surveys utilized either meandering or systematic transects. Transect spacing was based on the expected probability of encountering the targeted special-status plant species. Deviations were made from the transects to search special habitats, such as rock outcrops or seeps, with a higher probability of supporting special-status plant species. Survey intensity was determined based on the condition of a site, the types of natural communities present at a site, and the probability of encountering targeted plant species. Other considered factors included the expected population size of the target species and the visibility of the target species (i.e., the size and conspicuousness of plant species, vegetation cover and density, extent of livestock grazing, terrain, and other habitat conditions). The goal of determining survey intensity was to ensure that a population of the targeted special-status species would be encountered if present.

Natural Communities

Natural communities are grouped in the following categories: grassland, alkali wetland, intermittent pool, riparian woodland, chaparral, oak woodland, sandstone rock outcrop, and brackish marsh communities, and other habitats. The scientific names of plant species referred to in the text are listed in the Stage 2 EIR/EIS Technical Report (bound separately). The characteristic plant species, distribution, reasons for decline, and importance of natural communities in the project area are also presented in the Stage 2 EIR/EIS Technical Report (bound separately).

Grassland Communities

Grassland communities are typically herbaceous, but may support widely scattered buckeye, blue and interior live oak, or occasional shrubs. Groups of five or more trees within 100 feet of one another are considered woodlands.

Annual grassland and valley needlegrass grasslands are the two grassland types that occur throughout the project area, extending from valley bottoms to ridges of adjacent foothills. Grassland communities of the project area protect watershed lands from erosion and serve as the primary forage source for domestic livestock. These communities also provide aesthetic values, exemplified by wildflower displays in spring and golden waves of dry grass during summer, that characterize much of California's natural landscape.

Valley needlegrass grasslands qualify as significant natural communities because of current sparse distribution relative to historical widespread extent, limited amount of protected occurrences, and threats facing remaining occurrences. Valley needlegrass grasslands in the project area have survived despite over 100 years of livestock grazing in the area. Consequently, they are not considered sensitive to moderate levels of grazing or passive recreation use. The primary reason for treating these occurrences as significant natural communities, however, is to ensure that occurrences in the project area are protected from project-related development or other incompatible land uses.

Alkali Wetland Communities

Alkali wetland communities, including alkali grassland, alkali meadow, valley sink scrub, alkali marsh/seep, and northern claypan vernal pools, develop in flat or gently sloped valley bottoms with alkaline soils. Variation in soil, topography, and surface drainage in these valleys creates a mosaic of habitats, each occupying a distinct position along a hydrologic gradient. Alkali grasslands occur in drier areas while alkali meadows, valley sink scrub, and alkali marshes occur at successively wetter sites. Drainages and northern claypan vernal pools are interspersed within this mosaic. Alkali marshes are interspersed with alkali meadows in stringers along both Brushy and Kellogg Creeks. Alkali marshes are similar to freshwater marshes in structure, but occur on alkaline soils and support halophytic species in addition to typical freshwater marsh species such as tules and cattails.

In the project area, alkali wetland communities are found in the northeast and south-central portions of the Kellogg Creek watershed. Beyond the watershed, alkali wetlands, including alkali grasslands, meadows, and marshes; valley sink scrub; and northern claypan vernal pools, are found in valley bottoms from the watershed east to Byron Tract, north beyond the City of Byron, and south to Altamont Pass and beyond. Additional occurrences are scattered throughout the foothills along the western edge of the San Joaquin Valley.

Alkali wetlands are jurisdictional wetlands under Section 404 of the Clean Water Act and are significant natural communities because they are scarce, remaining occurrences are threatened, and they often exist in a degraded condition. They are also significant because they are important to dependent plant and wildlife species.

Acreage estimates for alkali wetlands presented in a Jones & Stokes Associates study (1989) were based on preliminary reconnaissance-level mapping. Subsequent surveys and wetland delineations have revealed that the acreages of these communities were overestimated. Acreage figures presented in this report, therefore, supersede those in previous reports. Acreages reported for alkali grasslands include areas identified in previous reports as "ephemeral drainages".

Intermittent Pool Communities

Intermittent pools are unique vegetated seasonal wetlands. One such community, known as valley rock outcrop intermittent pools, occurs in the project area. These communities form in depressions in sandstone outcrops found along ridgetops of the watershed and adjacent foothills to the west. Valley rock outcrop intermittent pools qualify as jurisdictional wetlands and are important because they are extremely rare and are important to dependent plant and wildlife species.

Riparian Woodland Communities

Riparian woodland communities, including willow-cottonwood riparian woodland, Central Coast live oak riparian woodland, and mixed riparian woodland, occur as narrow strips of woody vegetation along intermittent drainage and creeks throughout the project area. They are concentrated along Kellogg and Brushy Creeks. Willow-cottonwood riparian woodland is the only type that qualifies as jurisdictional wetlands under Section 404 of the Clean Water Act.

Riparian woodland communities are considered significant natural communities because they are locally and regionally scarce compared to their historical distribution and are important to dependent plant and wildlife species. The substantial local and statewide decline of lowland riparian woodlands and forests in recent years has increased concerns for dependent plant and wildlife species, leading DFG and USFWS to adopt no-net-loss policies to help arrest further declines (California Fish and Game Commission 1987, 46 FR 7656-7663, January 23, 1981).

Chaparral Communities

Chaparral communities in the project area include Diablan sage scrub and northern mixed chaparral that occur on rocky east- and north-facing slopes along ridges west of Vasco Road. They are dominated by evergreen, woody shrubs with a subshrub layer, and a variety of annual and perennial herbs. They occur along dry rocky slopes, ridges, and disturbed sites in the project area. Chaparral communities are valued because they help abate soil erosion; protect water quality; and provide foraging habitat and cover for deer, Alameda whipsnake, and other wildlife.

Oak Woodland Communities

Oak woodland communities, including valley oak woodland, blue oak woodland, live oak woodland, and mixed north slope cismontane woodland, occur in valley bottoms and on gentle to steep slopes throughout the project area. Oak woodlands have a sparse to dense tree canopy with a grassland understory. Some stands also have a shrubby midstory layer. Oak woodland communities are valued because of their role in soil stabilization and erosion abatement, both of which help maintain water quality. They also provide valuable habitat for wildlife, including deer and golden eagles, and are an important forage resource for livestock.

Valley oak woodlands in the project area deserve special consideration because of their local rate of loss and lack of reproduction and because of statewide concerns over the future viability of the community. Statewide and local concerns about the future viability of valley oak woodlands exist because of continued losses attributable to development, firewood harvest, and lack of seedling recruitment. Deep, fertile soils; proximity to water in the floodplain aquifer; and low flood frequency make habitats that support this community highly valued for agriculture. Consequently, it is one of the rarest of the Central Valley woodland communities. This rarity increases the value of remaining Sierra Nevada and Coast Ranges woodland occurrences, including those in the project area.

In Contra Costa County, little information on the extent and location of valley oak woodlands is available (Olsen and Greenwood pers. comms.). However, the Los Vaqueros Reservoir occurrence is suspected to be one of the largest remaining woodlands (Muick and Olsen pers. comms.). Only a few valley oak woodland occurrences are protected on public lands, including occurrences in Mt. Diablo State Park and Morgan Territory, Briones, Black Diamond Mines, and Las Trampas Regional Parks (Olson pers. comm.).

Valley oak woodland occurrences in the project area are declining. Individual trees in the Los Vaqueros Reservoir inundation area were tracked from 1938 to 1991 using aerial photographs. During this 53-year period, the area was actively plowed, dryland farmed, and grazed. A total of 73 of the 965 trees evaluated were extirpated, representing a loss of 7.6% of the trees present in 1938.

Little or no reproduction of valley oaks was observed during 1990 and 1991 surveys; no seedlings were encountered and only 26 saplings, representing approximately 2% of the total population, were observed. The majority of the few observed acorns had been damaged by insects or rodents, as evidenced by bore holes, hollow acorns, and gnaw marks.

Extensive research has been done on the decline of valley oaks in California (Callizo 1983, Dutzi 1979, Fieblekorn 1972, Griffin 1973). Possible explanations for the degraded condition and high mortality rate of valley oaks in the project area include natural aging of trees, disease or insect infestation, impacts of continued plowing and grazing (e.g., soil compaction, changes in understory composition, or mechanical damage), firewood harvest, and possible lowering of the groundwater table because of groundwater pumping. Possible explanations for the lack of seedling establishment include competition from non-native annual species, herbivory by livestock and rodents, insect infestations, insufficient rainfall or other climatic aberrations, and disturbance from agricultural practices (Griffin 1973, 1976; Menke and Fry 1980; Wagnon 1946; Fitch 1948).

Valley oaks were observed in two topoedaphic settings in the project area: along creeks and drainages, and in deep alluvial soils in valley bottom floodplains. Occurrences along creeks and drainages are referred to as valley oak woodlands because they typically were clustered in stands of five to 50 trees, with dense canopy cover and a sparse understory. Occurrences in valley bottom floodplains are subsequently referred to as valley oak savannas because they typically consisted of widely spaced individuals or small clusters of two to five trees interspersed with large areas of annual grasslands.

Several possible explanations exist for the observed difference in woodland structure between these two settings. Based on a review of historical aerial photographs, floodplain areas have been dryland farmed and grazed since 1938; agricultural activities are likely to have also occurred in these areas before 1938. Constant ground disturbance (e.g., plowing, harvesting, and livestock grazing) may have prevented seedling establishment and lead to a more open-canopied structure in the valley oak savanna. Firewood harvesting, tree removal for farming purposes, lack of adequate water, and natural aging of trees may all have contributed to the observed open-canopied structure. In contrast, increased water availability may have allowed more oaks to establish along creeks and drainages, resulting in a much denser canopy cover in valley oak woodlands. Valley oaks in these areas may have been protected from plowing, harvesting, and firewood harvest because of their less-accessible position along steep drainages.

Valley oaks appear to be hybridizing with blue oaks because some trees observed had intermediate leaf size, shape, and color; bark characteristics; and growth habit. Hybridization in oaks, including valley and blue oaks, has been reported throughout California (Howitt and Howell 1973, Sargent 1918, Twisselman 1969). In the project area, valley oaks with hybrid characteristics were consistently observed along steep hill-slope drainages and other relatively dry microhabitats, while pure valley oaks were consistently found in relatively flat areas and along intermittent creeks of valley bottoms. A possible explanation for this observation is that the drought-tolerant characteristics of blue oaks may permit the putative hybrids to occupy drier microhabitats than pure valley oak.

Brackish Marsh Community

Brackish marsh occurs along the interior edges of coastal bays, deltas, and estuaries, and is most extensively developed around Suisun Bay in the Delta. In the project area, this community occurs adjacent to the Sacramento-San Joaquin River, northwest of Pittsburg along the desalination brine disposal pipeline. This community provides important habitat for dependent plant and wildlife species and helps abate erosion.

Other Habitats

Other habitats include sandstone rock outcrops, stock ponds, agricultural and fallow fields, dryland farmed grasslands, and developed lands that occur throughout the project area, mostly in valley bottoms and adjacent foothills. These habitats are marginally important to native vegetation, but provide important habitat for wildlife.

Wetlands and Other Waters of the United States

Eight natural communities in the project area qualify as jurisdictional wetlands (regulated under Section 404 of the Clean Water Act): alkali grasslands, alkali meadows, valley sink scrub, alkali marshes, northern claypan vernal pools, valley rock outcrop intermittent pools, willow-cottonwood riparian woodlands, and brackish marshes (Contra Costa Water District 1990b).

Most stream channels, drainages, and stock ponds that did not qualify as wetlands did qualify as other waters of the United States (Contra Costa Water District 1990b).

Special-Status Plant Species

Results of Prefield Investigation

During a prefield investigation, 25 special-status plant species were identified as known or suspected to occur in the project area. Information on the legal status, distribution, habitat associations, reasons for legal status (i.e., discussion of threats), and period of identification are summarized in the Stage 2 EIR/EIS Technical Report (bound separately).

Most of these 25 species have been reported from sites within 5 miles of the project area, including historical records for Contra Costa goldfields, diamond-petaled California poppy, recurved larkspur, caper-fruited tropidocarpum, and showy Indian clover (Natural Diversity Data Base 1991). More recent records are available for the remainder of the species listed in the Stage 2 EIR/EIS Technical Report (bound separately) including California hibiscus, palmate-bracted bird's beak, hispid bird's beak, brittlescale, San Joaquin spearscale, Mason's lilaeopsis, and Antioch Dunes evening primrose. (Natural Diversity Data Base 1991).

Field Survey Results

Six of the 25 targeted special-status plant species were located during field surveys of the project area: Mt. Diablo manzanita, brittlescale, San Joaquin spearscale, Diablo helianthella, Brewer's dwarf flax, and stinkbells (Jones & Stokes Associates 1989, 1990c, 1990d, 1991g). Mt. Diablo manzanita, Diablo helianthella, Brewer's dwarf flax, and stinkbells were located within the watershed, concentrated along the

foothills and ridges west of Vasco Road. Brittlescale and San Joaquin spearscale were distributed in patches in the watershed and were located along water conveyance corridors, extending from the watershed east to Clifton Court Forebay and north to Discovery Bay. The first five of these species are candidates for listing under the federal Endangered Species Act. The sixth species, stinkbells, was recently removed from the candidate list, and is discussed below. Although considerable effort was expended searching in the vicinity of Byron Hot Springs and Mountain House, none of the remaining 19 targeted special-status plant species listed above were located.

Stinkbells were located in the Kellogg Reservoir inundation area, and along Camino Diablo Road. Stinkbells, one of the species identified as a special-status plant, has been removed from the list of candidate species by USFWS (55 FR 6184, February 21, 1990). Botanists familiar with the species were interviewed by telephone (Raiche, Edwards, Morgan, Taylor, Robinette, Roderick, Santana pers. comms.) and a literature review was conducted to assess the current status of the species throughout its range. An overwhelming majority of those interviewed indicated that they still consider the species to be threatened, regardless of the delisting by USFWS. Their conclusions were based on observations of populations that were monitored over a period of years. These botanists report widespread elimination of known populations through land conversion to residential and commercial use, lack of recruitment of new plants into existing populations, lack of seed set in populations, and an overall reduction in population size as factors supporting its status as a rare, possibly threatened species. Based on the best available information (expert opinion and current scientific research), this species meets the criteria listed above for special-status species.

Importance of Project Area Occurences. The following discussion is based on a review of NDDB record (1991) and discussions with NDDB staff (Townsend pers. comm.).

Collectively, the project area supports the second largest recorded occurrence of Mt. Diablo manzanita, totaling over 700 plants. The largest occurrences is reported from Mt. Diablo State Park.

Twenty populations of brittlescale totaling over 22,000 plants were located in the project area. The importance of this species is difficult to assess because of the lack of other recorded occurrences. However, the project area occurrence is considered important, based on the substantial historic losses and trend toward increasing regionwide loss of alkali habitats that support the species.

The project area's 60 populations totaling approximately 92,000 San Joaquin spearscale plants collectively represents the highest concentration of plants reported and include the largest known occurrence for the species. The area from the Kellogg Creek watershed, south to Livermore, and east to Byron represents a current stronghold for the species.

Stinkbell populations totaling 2,100 plants are widespread and small to moderate in size. This species is known from numerous occurrences in a wide geographic range; however, project area occurrences are considered important because of the continued loss of populations in the region from land conversion.

Thirty-one populations totaling over 2,500 plants represents an estimated 30-60% of the total known occurrences for Diablo helianthella. Collectively, the watershed populations represent the largest concentration of this species outside Mt. Diablo State Park.

Brewer's dwarf flax occurrences totaling 9,000 plants represents a substantial portion of the total known occurrences, and the largest recorded population. However, more populations are expected to exist, and may decrease the overall importance of the project area occurrences.

ENVIRONMENTAL CONSEQUENCES

Criteria for Conclusions of Significance

Conclusions regarding the significance of impacts on vegetation resources are based on criteria in the State CEQA Guidelines and NEPA regulations. Justifications for conclusions of significance are provided below.

Common Natural Communities

Impacts on common natural communities are considered significant if a substantial portion of the community type would be eliminated, when compared to its extent in the project area, Mt. Diablo range, and Contra Costa County. The ability and speed of natural regeneration processes to recover lost values were also considered in this assessment.

Significant Natural Communities and Jurisdictional Wetlands

The State CEQA Guidelines define project effects that substantially diminish habitat for fish, wildlife, or plants or that disrupt or divide the physical arrangement of an established community as significant impacts. Based on this definition, the loss or degradation of significant natural communities or jurisdictional wetlands would be considered a significant effect. Refer to "Significant Natural Community" above in the "Definitions" section for a description of a significant natural community and to the "Wetlands" section above for a description of a jurisdictional wetland.

Other Waters of the United States. Impacts on areas that qualify as other waters of the United States would be considered significant if a substantial portion were eliminated when compared to the extent in the project area, as described above under "Common Natural Communities".

Special-Status Plant Species

Impacts on special-status plant species are considered significant if eliminating or degrading the population would adversely affect the species (State CEQA Guidelines and NEPA regulations) or if eliminating or degrading a community on which they depend could threaten their existence. The loss of an entire population of a special-status plant species was considered to have a greater effect on the species than partial removal or fragmentation of a population, but both would be considered a significant impact under this definition. Refer to "Special-Status Plant Species" above in the "Definitions" section for a description of a special-status plant species.

Impact Mechanisms

This section describes the mechanisms by which botanical resources could be affected by the proposed project or alternatives.

Facility Construction

Facility construction could temporarily disturb or permanently eliminate botanical resources. Underground facilities, such as pipelines, could eliminate botanical resources at the facility site, adjacent to the pipeline and could temporarily disturb resources. Construction of aboveground facilities could eliminate botanical resources in the final footprint of the project feature. Features with generalized locations, such as petroleum and gas pipelines and transmission lines, would affect a relatively small area in the adopted corridors and these facilities can, in most cases, be designed to avoid significant resources. For the purpose of impact assessment, a 150-foot-wide impact area was assumed for the gas and petroleum pipelines, and a 40-foot by 40-foot impact area was assumed at each transmission tower location.

The term "facility construction" as used in this analysis consists of the following project components:

- dams, reservoir inundation area, quarry, spillway, and inlet/outlet works;
- recreational facilities (e.g., picnic areas, camping facilities, trails, access roads, staff housing, maintenance facilities, and concession stands);
- water conveyance facilities (i.e., intake facilities, transfer reservoirs and pumping plants, conveyance facilities, the Neroly blending facility, and associated electric transmission lines);
- Vasco Road and utility relocation alignments (i.e., County Line Vasco Road Alignment and natural gas pipeline, petroleum pipeline, and electric transmission line alignments);
- desalination facilities (i.e., desalination plant, brine disposal pipeline, EBMUD intertie pipeline, and associated electric transmission lines); and
- Middle River intake/EBMUD emergency supply facilities (i.e., Middle River intake facility and pumping plant, Middle River pipeline, EBMUD intertie pipeline, Neroly blending facility, and associated electric transmission lines).

Spoil Disposal. Disposal of spoil materials associated with pipeline burial and dam construction could eliminate botanical resources at dump sites. Most disposal areas, however, are located either in the inundation zone for the Los Vaqueros Reservoir and Kellogg Reservoir sites or in pipeline study corridors that cross agricultural fields. Spoil disposal may also result in erosion and other incidental construction effects in areas adjacent to disposal sites, as described below in the "Incidental Construction Impacts" section.

Incidental Construction Impacts

Incidental construction effects are construction-related impacts in areas adjacent to construction sites. Incidental construction effects could result from activities such as material preparation and storage, spoil disposal, vehicle access to construction sites, unintentional use of heavy equipment in areas adjacent to project facilities, equipment parking, and erosion.

Erosion could result from soil disturbance and may lead to soil loss or deposition, drainage downcutting, and headwall erosion. These effects could eliminate natural communities. Grading, trenching, creating mounds, or creating tire ruts during equipment use can also cause erosion.

Soil surface alterations, such as tire ruts, soil mounds, and ditches, could affect downslope areas by altering the amount and duration of water runoff. Soil surface alterations thus could separate a wetland community from an upslope watershed or substantially change a site's hydrology, causing changes in the species composition or possibly the loss of water on which a downslope wetland community depends.

Reservoir Operation, Land Management, and Use

Management and operation of the Los Vaqueros Reservoir and watershed area could adversely or beneficially affect botanical resources in the zone of reservoir water level fluctuation or along Kellogg Creek downstream of the reservoir. Land management practices likely to affect botanical resources are reservoir operation, grazing, fire management, and wind energy development.

Reservoir Operation. Reservoir operations could affect botanical resources because of changes in the release of water into Kellogg Creek. Fluctuating reservoir water levels could eliminate, degrade, or modify existing botanical resources below the reservoir high-water mark.

Grazing. Grazing could either beneficially or adversely affect botanical resources, depending on stocking rates, distribution of livestock, and other management practices. High stocking rates, improper livestock distribution, and the season and duration of grazing could result in livestock overutilization and could lead to increased erosion, reduced in species richness or diversity, degraded significant natural communities, and possible adverse effects on special-status plant species and wetlands. Lower stocking rates and more efficient livestock distribution (compared to preproject conditions), on a seasonal or spatial basis, could benefit botanical resources. Opportunities to enhance botanical resources in the watershed by implementing improved grazing management are available because large areas have been subject to long-term grazing overutilization (Jones & Stokes Associates 1991c).

Fire Management. Fire management can either beneficially or adversely affect botanical resources. Burn timing and intensity can influence the structure and composition of plant communities. Fires that occur more frequently than under natural conditions, controlled burns conducted during winter or spring, or fires of such intensity that hydrophobic soils are created, can significantly degrade botanical resources. In contrast, prescribed fire that mimics natural conditions can maintain current resource values and enhance aging stands of vegetation in areas that have not burned recently. Special-status plant species in the watershed are presumably well adapted to natural fire because they occur in plant community types that burned periodically before the onset of human fire suppression activities. Special-status plant species that occur in openings and edges of chaparral and woodland vegetation may benefit from fire. Eliminating shrub canopy or dense understory species may promote seedling establishment by reducing competition and increasing the amount of suitable habitat.

Fuelbreaks along ridgetops, constructed with bulldozers, could adversely affect special-status plant species. Such cleared areas along steep slopes could lead to erosion and, hence, indirect impacts on both special-status plant species and communities downslope from firebreaks.

Wind Energy Development. Construction of new wind turbines and access roads by wind energy developers on watershed lands could affect botanical resources at wind energy facility sites. Downslope erosion or other impacts of construction could have an adverse impact on plant populations.

No-Action Alternative

Land Conversion. Based on the recently adopted Contra Costa County general plan (Contra Costa County Community Development Department 1991), most of the project area, with the exception of water conveyance corridors north of the watershed and near Byron, would remain primarily agricultural.

Based on the currently adopted Contra Costa County designated urban limit lines, land conversion is only expected adjacent to Discovery Bay (west of Brentwood and north of the watershed) and near Byron Hot Springs. At this time, the only approved development known in the Kellogg Creek watershed area is

the Bankhead Ranch project. CCWD is acquiring the Bankhead Ranch parcel as part of its plan to acquire land in the Kellogg Creek watershed. This development would therefore be precluded from proceeding.

Undeveloped Lands. Under the No-Action Alternative, existing land uses in undeveloped portions of the Kellogg Creek watershed are assumed to continue. Ongoing activities, such as dryland farming, grazing, and wind energy generation, are expected to result in continued loss and degradation of botanical resources, including alkali wetland communities, valley needlegrass grasslands, valley oak woodlands, and special-status plant species populations.

Botanical resources in undeveloped portions of the project area are expected to degrade further from dryland farming, grazing, groundwater pumping, firewood harvest, and wind energy development. For example, valley oak woodlands in the Los Vaqueros Reservoir inundation area are declining at a rate of 1.4 trees per year. If the current rate of decline continues, 21 additional valley oaks are expected to be lost by 2020, leaving a total of 944 trees. Similar degradation also is expected in alkali wetlands, valley needlegrass grasslands, and special-status plant species, although the current or future rate of degradation or loss cannot be predicted.

Los Vaqueros Reservoir Alternative

Impacts discussed under this alternative are divided into the seven alternate project configurations described in Chapter 2. This section describes minor additional survey needs; impacts of the dam, reservoir, and spillway; and impacts expected from recreational facilities and water conveyance features. This section also summarizes the Vasco Road and utility relocation impacts and compares the impacts expected under each of the seven Los Vaqueros Reservoir Alternative configurations. For each configuration, the impacts are first described by component. The impact section for each configuration then concludes with a summary of all associated impacts and conclusions regarding their significance.

Impacts Common to All Alternate Configurations

Potential for Impacts on Botanical Resources in Unsurveyed Portions of the Project Area. Although CCWD has conducted botanical surveys throughout most of the project area (over 20,000 acres), small portions (approximately 20 acres) of the petroleum pipeline relocation and water conveyance pipeline corridors have not been surveyed thoroughly because of lack of property access or lack of information on specific alignments. Although significant botanical resources could occur in these unsurveyed areas, adverse effects probably could be avoided by adjusting project features to avoid any significant natural communities and special-status plant species.

Facility Construction: Dam, Reservoir, Quarry Site, and Related Facilities. Construction of the dam and spillway and filling of the reservoir would eliminate common natural communities, including 542.0 acres of annual grasslands, 20.8 acres of blue oak and 0.1 acre of mixed north slope cismontane woodland, 737.1 acres of dryland farmed grasslands; and 7.0 acres of agricultural and developed lands (Table 7-1).

Dam, reservoir, and related facility construction would eliminate the following significant natural communities: 0.1 acres of alkali meadow, 9.4 acres of alkali marsh/seep, 0.2 acre of central coast live oak riparian woodlands, and 0.3 acre of willow-cottonwood riparian woodland (Figure 7-1). In addition, reservoir inundation would eliminate 180 acres of mature valley oak woodlands, representing 80% of the valley oak woodlands in the watershed and a fraction of 1% of the estimated thousands of acres of remaining valley oak woodlands in Contra Costa County. An estimated 1,042 valley oak trees (most of which are estimated to be 150-250 years old, with a median diameter at breast height [dbh] of 26-30 inches) would be eliminated by inundation.

Table 7-1. Acres of Natural Communities Affected by Construction of the Dam, Reservoir, Road, and Utility Relocation Facilities under the Los Vaqueros Reservoir Alternative

Natural Community	Facility						Total Acres Affected
	Los Vaqueros Dam, Reservoir, Spillway, and Quarry Sites	Los Vaqueros Pipeline	Relocated Vasco Road	Petroleum Pipelines	Natural Gas Pipelines	Electric Transmission Line	
Common natural communities							
Grassland community							
Annual grassland	542.0	114.0	152.9	90.1	99.7	0.8	999.5
Oak woodland communities							
Blue oak woodland	20.8	0.0	2.3	12.5	0.0	0.0	35.6
Mixed north slope cismontane woodland	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Other habitats							
Dryland farmed grassland	737.1	4.8	37.2	0.0	0.0	0.0	779.1
Agricultural and developed lands	7.0	101.9	0.0	0.0	0.0	0.0	108.9
Significant natural communities							
Alkali wetland communities[a]							
Alkali grassland	0.0	0.0	2.0	<0.1	0.0	0.0	2.0
Alkali meadow	0.1	0.0	1.2	0.0	<0.1	0.0	1.3
Alkali marsh/seep	9.4	2.0	0.2	0.0	0.0	0.0	11.6
Northern claypan vernal pool	0.0	0.0	<0.1	0.0	0.0	0.0	<0.1
Riparian woodland communities							
Willow-cottonwood riparian woodland[a]	0.3	2.8	0.2	0.0	0.0	0.0	3.3
Central coast live oak riparian woodland	0.2	0.0	0.0	0.0	0.0	0.0	0.2
Mixed riparian woodland	0.0	0.1	0.0	0.0	0.0	0.0	0.1
Oak woodland community							
Valley oak woodland	180.0	0.0	0.1	<0.1	0.0	0.0	180.1
Other waters of the United States[a]							
Stock ponds	0.2	0.0	2.6	0.0	0.0	0.0	2.8
Drainages	0.9	0.0	0.9	0.1	<0.1	0.0	1.9

[a] Under federal jurisdiction pursuant to Section 404 of the Clean Water Act (1977).

Of the significant natural communities, alkali meadow, alkali marsh/seep, and willow-cottonwood riparian woodlands are jurisdictional wetlands. The dam, reservoir, and related facilities would eliminate 9.8 acres of jurisdictional wetlands and 1.1 acres of other waters of the United States (i.e., 0.2 acre of stock pond and 0.9 acre of drainage).

The dam, reservoir, and related facility sites do not support special-status plant species.

Facility Construction: Recreation Facilities. Some of the preliminary general locations of recreational facilities presented in the conceptual recreation plan contain both significant natural communities (i.e., central coast live oak riparian woodlands; willow-cottonwood riparian woodlands; alkali grasslands, meadows, and marshes; northern claypan vernal pools; valley needlegrass grasslands; and valley oak woodlands) and special-status plant populations (i.e., San Joaquin spearscale, brittlescale, Brewer's dwarf flax, and Diablo helianthella) that could be affected by facility construction. However, impacts on these botanical resources would be unlikely for the following reasons:

- the project description (Chapter 2) requires that recreational facility placement avoid both significant natural communities and special-status plant populations,
- the conceptual recreation plan (Jones & Stokes Associates 1991d) includes guidelines to avoid facility placement on or near significant natural communities and special-status plant populations, and
- considerable opportunities exist for avoidance within the general recreation facility locations specified in the preliminary plan.

Should impacts on significant natural communities or special-status plant species occur, they would generally be significant.

Facility Construction: Water Conveyance, Intake, and Associated Electric Transmission Line Facilities. Preliminary locations for water conveyance facilities and their associated electric transmission lines contain botanical resources that could be eliminated by facility construction. For the purpose of this report, impact assessment assumes that all resources present in the study corridors could be eliminated. This assumption is based on the possible siting of spoil disposal sites and maintenance roads in water conveyance corridors. The following discussion presents a worst-case scenario for water conveyance features, as some opportunities for avoidance will be available during final project design. The width of studied water conveyance corridors varied between 400 and 1,000 feet, but actual pipeline construction would affect an area about 150 feet wide.

Los Vaqueros Pipeline. The Los Vaqueros pipeline would eliminate 114.0 acres of annual grasslands, 101.9 acres agricultural and developed lands, and 4.8 acres of dryland farmed grasslands.

The Los Vaqueros pipeline crosses several creeks and would eliminate a portion of two mixed riparian woodlands totaling 0.1 acre, 2.8 acres of willow-cottonwood riparian woodland, and 2.0 acres of alkali marsh/seep (Table 7-1). These areas are also considered jurisdictional wetlands.

Special-status plant species were not observed in the Los Vaqueros pipeline corridor, and no impacts on special-status plant species are expected.

Electric Transmission Line. The electric transmission line corridor contains annual grasslands, and is expected to only affect 0.8 acre of this community where the transmission towers are sited.

Incidental Construction Impacts. If construction activities result in erosion, or other activities eliminate, fragment, or degrade significant natural communities or special-status plant species or the areas that support them, the impact would be significant.

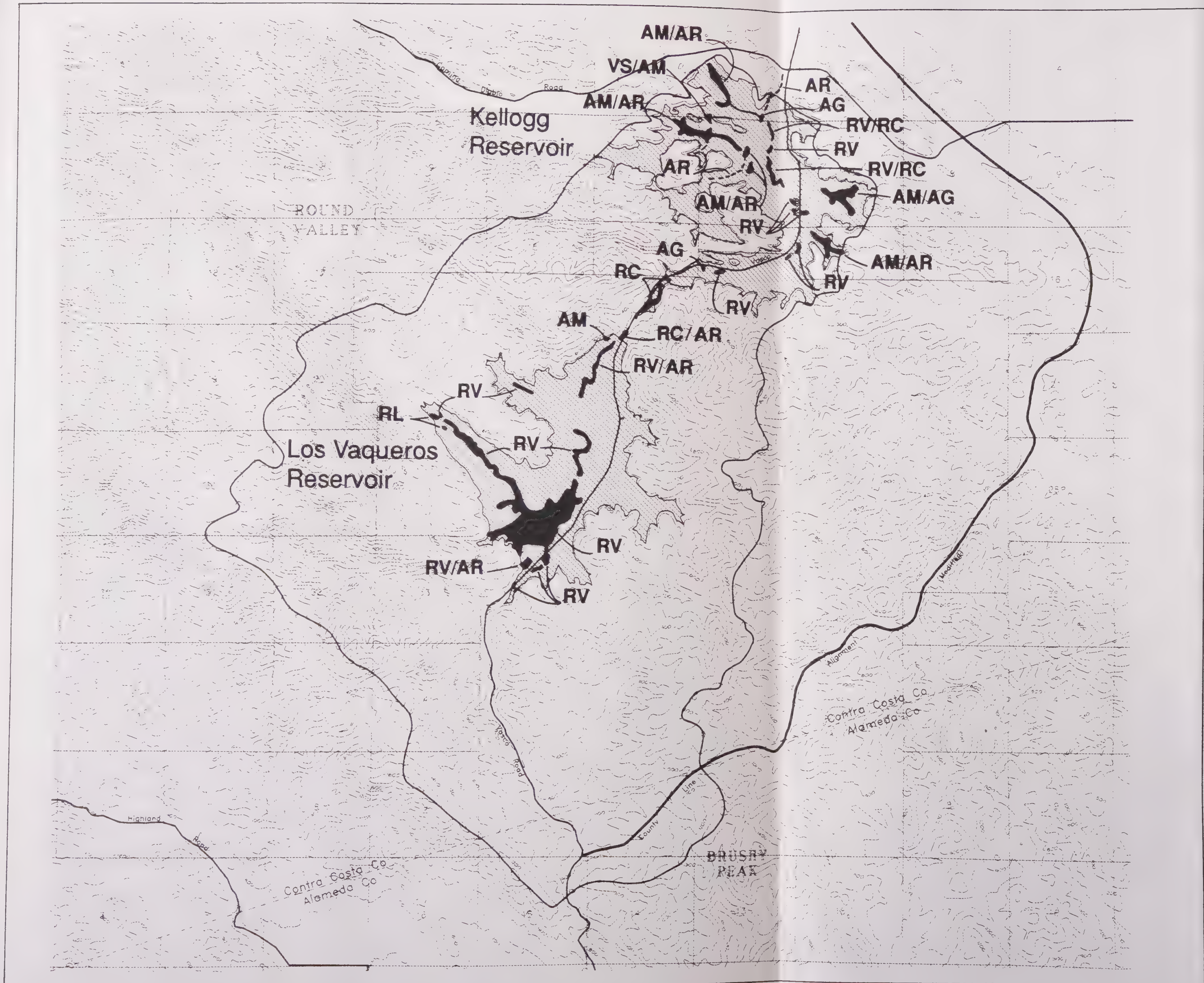


Figure 7-1.
Significant Natural Communities
Located in the Los Vaqueros
Reservoir and Kellogg Reservoir
Inundation Areas

LEGEND

AM = alkali meadow
AR = alkali marsh
AG = alkali grassland
RV = valley oak woodland
RC = willow cottonwood riparian woodland
RL = central coast live oak riparian woodland
VS = valley sink scrub

0 1
Mile

Reservoir Operation, Land Management, and Use. The following section discusses effects on botanical resources of reservoir operation, watershed land use policies likely to be adopted by CCWD, and the effects of recreational uses.

Purchase and Protection of Watershed Lands. CCWD acquisition of watershed lands and related facility corridors would result in the protection of thousands of acres containing blue oak woodlands; hundreds of acres containing alkali wetlands, riparian woodlands, and valley needlegrass grasslands; and tens of acres containing valley oak woodlands. With the exception of valley oak woodlands and annual grasslands, all the natural communities in the Kellogg Creek watershed would be protected. More than 50 San Joaquin spearscale, 10 brittlescale, four stinkbell, 30 Diablo helianthella, nine Mt. Diablo manzanita, and 25 Brewer's dwarf flax populations also would be protected under CCWD's acquisition.

CCWD policy would require that lands be managed to maintain or enhance existing resource values; purchase and protection, therefore, would be a beneficial impact of this alternative.

Purchase and protection of alkali wetland communities and their associated special-status plant species (brittlescale and San Joaquin spearscale) would be beneficial because these communities are not currently protected locally and because the alkali wetlands in the project area are relatively large and continuous and occur in their natural geomorphological context.

Reservoir Operation. Routine reservoir operations, such as water releases that result in seasonal water level fluctuations and releases from the reservoir into Kellogg Creek could affect botanical resources. Periodic wetting and drying or changes in the timing or amount of inundation could eliminate, degrade, or alter the species composition of natural communities or special-status plant populations.

For this analysis, botanical resources that occur below the high-water elevation of the reservoir are assumed to be eliminated. Under normal circumstances and average rainfall, the water level in the reservoir is expected to fluctuate 5 to 15 feet per year. Botanical resources, such as annual grasslands and oak woodlands below the reservoir high water mark, are likely to be affected by the fluctuations and will likely be replaced by species such as smartweed, cocklebur, and star thistle that periodically colonize exposed reservoir shorelines at nearby sites. Typical wetland species, such as cattail marshes or willows stands, will likely establish around the shoreline and in areas where drainages flow into the reservoir. Wetland vegetation establishing in these areas is not expected to persist because annual reservoir drawdown, especially during low rainfall years, would dessicate wetland vegetation. Therefore, reservoir operations are not expected to result in beneficial impacts on wetlands.

Effects on Downstream Wetlands. All flows of 5 cfs or less that enter the reservoir will be released to the downstream portion of Kellogg Creek. Additionally, CCWD will release downstream flows sufficient to maintain wetlands that occur between the Los Vaqueros dam site and Camino Diablo Road. Because no change in the amount or timing of these low flows, which comprise the majority of Kellogg Creek flows, is expected, impacts on downstream botanical resources would be less than significant.

Land Management: Grazing. Watershed lands will be managed to meet or exceed minimum management recommendations for leaving residual dry matter (RDM), as described for annual grasslands in the U.S. Forest Service's range environmental analysis handbook (Cox pers. comm.). CCWD recognizes that many annual grasslands in the watershed have been grazed at levels exceeding recommended RDM standards. As these lands are acquired, overall grazing intensity is expected to decrease to reduce potential water quality problems, maintain forage production, and protect biological resources. A net reduction in grazing intensity is expected to be a beneficial impact on botanical resources by increasing overall vegetative cover and improving species diversity. Uncommon native forbs and grasses and native bunchgrass species will become more common. Lands already acquired and managed by CCWD show significantly more vegetative cover than lands in the watershed managed by others (Jones & Stokes Associates 1991c). CCWD's grazing management would also result in a decrease in creek channel erosion and downcutting associated with localized overstocking, thereby improving both water quality and

natural hydrological functioning of alkali wetland and riparian communities. Valley needlegrass grasslands are likely to expand in vigor, areal extent, and density of bunchgrass plants because of more closely regulated grazing and CCWD's policy to manage this resource to increase the cover of native perennial grasses. Populations of San Joaquin spearscale and brittlescale also will increase in plant numbers and population vigor because of a decrease in mechanical damage (e.g., ingestion or trampling) and an increase in the number of plants and their seed production.

Reducing grazing intensity would not result in all areas continuously meeting RDM standards. Range conditions are likely to vary because of climatic fluctuations and uneven distribution of livestock that could lead to localized overutilization. Even if localized overutilization occurs, however, the effects of grazing would not be worse than existing conditions and are likely to be improved under CCWD management.

Land Management: Fuel and Fire. Fire management practices, including the creation of firebreaks, discing, and clearing, are expected to be utilized to reduce the risk of wildfire on watershed lands (Cox pers. comm.). These activities could eliminate or degrade botanical resources and could increase the number of affected acres if significant natural communities or special-status species are affected. Although impacts on botanical resources could occur, impacts are unlikely because ample opportunities for avoidance exist.

CCWD will develop specific fire management methods using the extensive available information on the location of special-status plant species and significant natural communities. CCWD is expected to use prescription burning as part of its management strategy for ridges west of Vasco Road. This strategy would primarily affect chaparral communities, with the objective of decreasing fuel load, improving the diversity of stand classes (i.e., stands of different ages), and enhancing biological values. Because CCWD management policy is to enhance or maintain existing biological resource values, prescription burns will be designed to achieve this objective and would be a beneficial impact of the project.

Land Management: Wind Energy Development. CCWD has not acquired and does not expect to acquire the leased wind energy development rights on lands it has acquired. CCWD will therefore have little control over wind energy development activities on CCWD lands that honor preexisting leases. Additional development under existing leases will proceed under Contra Costa and Alameda Counties' permitting processes, which make some accommodations to prevent resource impacts.

Although CCWD cannot prevent wind energy development on its lands where it does not own the wind energy rights, it does have limited authority to influence how development will proceed to protect its lands. Thus, CCWD could influence the locations of roads or turbine pad sites to prevent erosion or other resource impacts.

Land Use: Recreation. Impacts on special-status plant species and significant natural communities are not expected from subsequent recreational use of the watershed because:

- the project description (Chapter 2) describes CCWD's recreation management policies and states that special-status plant populations and significant natural communities shall be avoided;

- the adopted CCWD conceptual recreation plan includes provisions to protect special-status plant species and significant natural communities (e.g., placement of fences, buffer zones, signs and educational information, and relocation of recreational facilities away from sensitive botanical resources); and

- recreational use is expected to be monitored by an onsite land manager; potential problems can be corrected and impacts on botanical resources can be avoided through onsite management and monitoring.

Because a final recreation plan has not been developed or approved, significant impacts on botanical resources could occur.

Land Use: Research and Education. CCWD management of the watershed has provided, and would continue to provide, opportunities for research and education.

CCWD has expressed a strong interest in cooperative research efforts with colleges and universities. Currently, a research project is underway to establish a population of the federally protected large-flowered fiddleneck on watershed lands. This research is being conducted by Dr. Bruce Pavlick and several graduate students associated with Mills College, in cooperation with DFG and CCWD (Cox pers. comm.). Similar research could be conducted in conjunction with mitigation and monitoring efforts for oak woodlands, alkali wetlands, or special-status plant species. Such research could have a beneficial impact on botanical resources by contributing to the success of the mitigation program and by adding to existing scientific knowledge about these resources. Because of its strong interest in research, CCWD has identified a research and conference center as part of its conceptual recreation plan (Jones & Stokes Associates 1991d).

An educational program is proposed that would be designed for school programs and the general public and would include an environmental education area, interpretive center, and vegetation enhancement area for oak woodlands, including valley and blue oaks, and riparian woodlands. This program is expected to include interpretive signs and guided tours or pamphlets that provide information about botanical resources of the watershed.

Summary of Impacts: Vasco Road and Utility Relocation. The following discussion updates the impacts described in the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990). Refer to this document for a complete discussion of associated impacts and for locations of botanical resources along relocation corridors. Wetland acreage figures presented below for the relocated Vasco Road are based on a verified delineation of the relocated Vasco Road alignment (Contra Costa Water District 1990b) and supercede impact acreages identified in the previous document.

Final alignments for petroleum and natural gas pipelines and electric transmission line relocations have been identified for the Los Vaqueros Reservoir Alternative. The following impact assessment updates the number of affected acres presented in the Vasco Road and Utility Project EIR, which should be referred to for locations of botanical resources within utility relocation corridors.

Natural gas pipeline relocation would eliminate 99.7 acres of annual grassland and, by crossing Kellogg Creek, would affect less than 0.01 acre of alkali meadow. Although this alignment passes through blue oak woodlands, the pipelines would be configured to avoid oaks. Because the pipelines would be buried, natural regeneration of annual grassland would reduce impact acreages over time. This pipeline would also eliminate less than 0.1 acre of drainages that are other waters of the United States.

Electric transmission line relocation would affect botanical resources primarily at tower locations and would eliminate 0.8 acre of annual grassland. Additional impacts on botanical resources could occur along access roads to transmission towers because the location of access roads has not been determined. However, because they are located on hilltops that support annual grasslands and dryland farmed grasslands and would be constructed as spurs off existing roads, access roads are expected to avoid botanical resources.

Relocated petroleum pipelines would eliminate 90.1 acres of annual grassland and would pass through 12.5 acres of blue oak woodland. As described for natural gas pipeline impacts, the petroleum pipelines would be buried and designed to avoid most oaks; thus, the number of affected acres reported are likely to be greater than final impact acreages. Annual grassland impacts would decrease as natural regeneration restored most impact areas.

The relocation of Vasco Road would eliminate 152.9 acres of annual grasslands with a few scattered sandstone outcrops, 37.2 acres of dryland farmed grasslands, and 2.3 acres of blue oak woodlands.

Construction of the relocated Vasco Road would eliminate the following significant natural communities: 2.0 acres of alkali grasslands, 1.2 acres of alkali meadows, 0.2 acre of alkali marshes/seeps, 0.01 acre of northern claypan vernal pool, and 0.2 acre of willow-cottonwood riparian woodlands, all of which are considered jurisdictional wetlands (Table 7-1). Wetlands downslope from Vasco Road relocation were assumed to be eliminated if the road isolated them from upslope contributory watersheds. Vasco Road relocation would eliminate a small portion of valley oak woodland totaling 0.1 acre. The Vasco Road relocation also would eliminate 2.6 acres of stock ponds and 0.9 acre of drainages that qualify as other waters of the United States.

Implementing Vasco Road relocation is not expected to affect special-status plant species.

Secondary Impacts: Vasco Road Relocation. No projects have been newly proposed along the relocated Vasco Road that are related to the relocation of the road. Land use changes that have been proposed in the general road relocation area were already actively proposed or contemplated before CCWD proposed to relocate Vasco Road, and none of the projects depend on the relocated road.

The potential for future growth also was evaluated. In general, future growth along the alignment would be limited because of steep terrain.

Relocating Vasco Road could result in the loss or elimination of annual grasslands, dryland farmed grasslands, alkali wetland communities, willow-cottonwood riparian woodlands, and special-status plant species because of development that could potentially occur in areas adjacent to the new road. The loss of annual grasslands and dryland farmed grasslands would be a less-than-significant effect because these areas do not support important botanical attributes and are relatively widespread in the region.

Alkali wetlands, the special-status plant species populations they support, and willow-cottonwood riparian woodlands are considered susceptible to development impacts where they occur in large, flat-bottomed valleys adjacent to the relocation corridor. Secondary impacts related to the relocated road could result in significant adverse impacts if these resources are eliminated or degraded.

The existing Vasco Road corridor is much more conducive to new development, however, because large, flat areas are adjacent to the road in both the Kellogg Reservoir and Los Vaqueros Reservoir inundation zones. These areas also contain more sensitive biological resources. The Kellogg Reservoir inundation area contains over 130 acres of wetlands and numerous special-status plant species populations that comprise a total of nearly 100,000 individuals. These areas would be subject to development pressure similar to areas along the County Line Alignment if this alternative were not implemented.

Any proposed future development along the County Line Alignment would require a general plan amendment, rezoning, preparation of environmental documentation, and consultation with resource agencies. In addition, any substantial development proposed in wetland areas would require a permit under Section 404 and would be inconsistent with Contra Costa County general plan policies that require a setback of development from wetland areas. Significant impacts on wetlands and special-status plant populations are unlikely, but the potential does exist. Contra Costa County and other appropriate lead agencies would be responsible for reducing these impacts to less-than-significant levels by restricting access from the alignment to adjacent parcels, and carefully regulating parcel subdivision to limit development to large parcel uses.

Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance. The following discussion summarizes impacts common to all alternate configurations and makes conclusions regarding the significance of each effect. Numbers of affected acres are summarized in Table 7-1.

Impacts on Botanical Resources in Final Facility Locations and in Unsurveyed Portions of the Project Area. If impacts on significant natural communities and special-status plant species occur in final alignments for utility relocations and recreation facilities, they would be significant and would be added to the affected acres presented below. Affected acres presented are for alkali wetlands downslope and adjacent to Vasco Road relocation; a worst-case scenario is presented for these areas.

The growth-inducing effect of Vasco Road relocation could result in significant impacts on alkali wetland communities in four valley bottoms adjacent to the relocation corridor.

Loss of Common Natural Communities and Other Habitats. Facilities common to all alternate configurations would result in the loss of approximately 999.5 acres of annual grasslands, 35.6 acres of blue oak woodlands, 0.1 acre of mixed north slope cismontane woodlands, 779.1 acres of dryland farmed grasslands, and 108.9 acres of agricultural and developed lands (Table 7-1). Loss of these common natural communities would be a less-than-significant impact for the reasons listed above in the "Criteria for Conclusions of Significance" section.

The loss of 35.6 acres of blue oak woodland could be a significant impact. However, this loss is offset by the purchase, protection, and enhancement of over 4,000 acres of blue oak woodland in the watershed that would result from implementing the Los Vaqueros Reservoir Alternative. Under CCWD ownership, over 4,000 acres of blue oak woodlands would be enhanced by improved land management (e.g., decreased grazing intensity). Some existing blue oak woodlands would be restored, as part of an educational revegetation program identified in the conceptual recreation plan (Contra Costa Water District 1991d). Landscaping in and around recreation facilities would incorporate drought-resistant, native vegetation, including blue oaks. Thus, when viewed as a whole, the loss of a fraction of 1% of the blue oak woodlands would be offset by beneficial impacts of the project and, therefore, would be a less-than-significant impact.

Loss of Significant Natural Communities and Jurisdictional Wetlands. The following areas of significant natural communities would be affected by components common to all alternate configurations: 2.0 acres of alkali grasslands, 1.3 acres of alkali meadows, 11.6 acres of alkali marshes, 0.01 acre of northern claypan vernal pool, 3.3 acres of willow-cottonwood riparian woodlands, 0.2 acre of central coast live oak riparian woodlands, 0.1 acre of mixed riparian woodlands, and 180.0 acres of valley oak woodlands (Table 7-1). Of these communities, the alkali wetland communities and the willow-cottonwood riparian woodlands are considered jurisdictional wetlands.

Loss or degradation of alkali wetlands, mixed and willow-cottonwood riparian woodlands represents a significant impact for the reasons listed above under "Criteria for Conclusions of Significance".

Additional alkali wetland communities are vulnerable to secondary effects of Vasco Road relocation as described above. This effect would be a significant impact.

The loss of valley oak woodlands is considered a significant impact because this community is limited in the project area and Mt. Diablo region, is declining locally and statewide, and is important to dependent plant and wildlife species.

Loss of Other Waters of the United States. An estimated 4.7 acres of other waters of the United States could be affected by features common to all the alternatives (Table 7-1), including 2.8 acres of stock ponds and 1.9 acres of drainages. The loss of these areas in and of itself could be significant; however, lost habitat would be offset through the creation of hundreds of acres of open water habitat and over 10 miles of reservoir shoreline resulting from inundation of the reservoir site. Also, the replacement of most stock ponds would be expected as a condition of negotiations with grazing lessees. When viewed in the context of this project, loss of other waters of the United States would be a less-than-significant impact.

Incidental Construction Impacts. The extent of significant impacts on significant natural communities and special-status plant species reported above would increase if these resources were inadvertently affected by incidental construction impacts.

Reservoir Operation, Land Management, and Use. Operation of the Los Vaqueros Reservoir, CCWD management of watershed lands, and subsequent recreational use could increase the number of affected acres reported above if special-status plant species or significant natural communities were inadvertently affected.

Impacts of Alternate Water Conveyance Configurations

The following discussion focuses on the additional incremental impacts that would result from implementing each of the alternate water conveyance configurations (Figures 7-2 and 7-3). Incremental impacts of water conveyance configurations are presented in Table 7-2. The total impacts of each water conveyance configuration combined with components of the alternative that are common under each alternate confuguration are presented in Table 7-3.

Spoil disposal sites for construction of all of the alternate water conveyance configurations are located in agricultural fields and annual grasslands where no significant natural communities or special-status plants occur. Impacts would be less than significant.

Rock Slough/Old River No. 1 Configuration

Natural Communities. Implementation of this alternate water conveyance configuration would result in the loss of a small additional amount of common natural communities. These impacts would be less than significant as described above under "Criteria for Conclusions of Significance."

This configuration would also result in additional losses of significant natural communities, including 18.0 acres of alkali grasslands, 2.3 acres of alkali meadow, 0.8 acre of alkali marsh/seep, and 0.6 acre of northern clay pan vernal pool. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration could eliminate or fragment four populations totaling an estimated 400 brittlescale plants, and could eliminate one population and fragment one population of San Joaquin spearscale, affecting 1,500 plants. These impacts would be significant.

Rock Slough/Old River No. 2 Configuration

Natural Communities. Implementation of this water conveyance configuration would result in the loss of a small additional amount of common natural communities. These impacts would be less than significant as described above under "Criteria for Conclusions of Significance".

This configuration also would result in additional losses of significant natural communities, including 10.5 acres of alkali grassland, 5.1 acres of alkali meadow, 0.6 acre of alkali marsh/seep, and less than 0.1 acre of valley oak woodland. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration could result in the elimination of one San Joaquin spearscale population totaling 1,500 plants. This impact would be significant.

Rock Slough/Old River No. 3 Configuration

Natural Communities. Small additional amounts of common natural communities would be lost under this water conveyance configuration. These impacts would be less than significant.

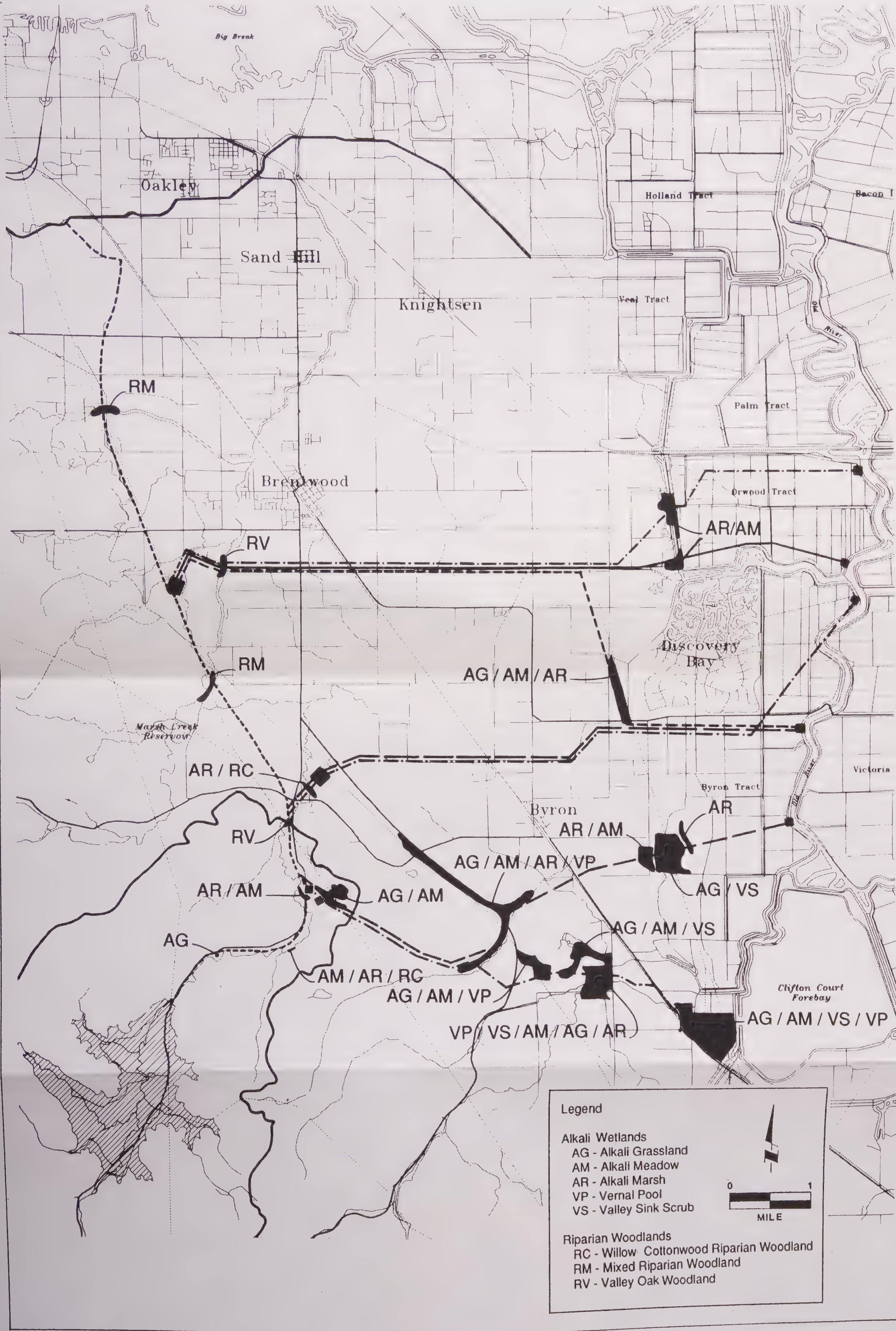


Figure 7-2. Significant Natural Communities in the Vicinity of the Los Vaqueros Reservoir Alternative Facilities (All Configurations)

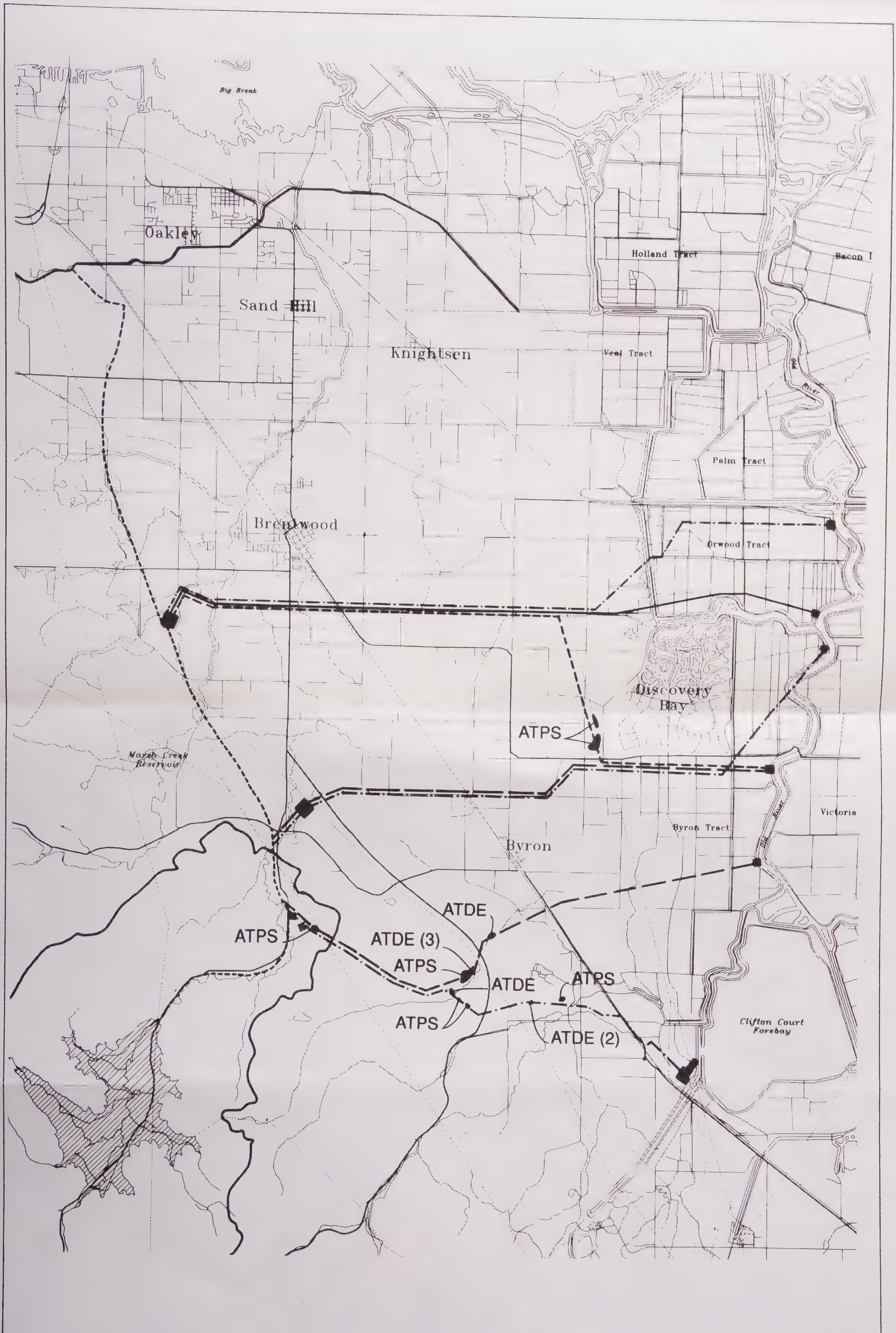


Figure 7-3. Special-Status Plant Populations in the Vicinity of the Los Vaqueros Reservoir Alternative Facilities (All Configurations)

Table 7-2. Acres of Natural Communities Affected by Construction of Alternate Water Conveyance, Intake, and Associated Electric Transmission Line Facilities of the Los Vaqueros Reservoir Alternative

Natural Community	Water Conveyance Facility[a]						
	Old River No. 1	Old River No. 2	Old River No. 3	Old River No. 4	Old River No. 5	Old River No. 6	Clifton Court Forebay
Common natural communities							
Grassland community							
Annual grassland	51.0	80.6	10.0	10.0	27.0	19.0	53.3
Other habitats							
Dryland farmed grassland	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Agricultural and developed lands	59.3	86.5	183.1	168.1	104.1	143.3	25.1
Significant natural communities							
Alkali wetland communities[b]							
Alkali grassland	18.0	10.5	<0.1	<0.1	<0.1	<0.1	13.9
Alkali meadow	2.3	5.1	1.4	4.0	0.6	0.6	3.4
Valley sink scrub	0.0	0.0	0.0	0.0	0.0	0.0	1.8
Alkali marsh/seep	0.8	0.6	0.5	4.0	0.1	0.6	0.8
Northern claypan vernal pool	0.6	0.0	0.0	0.0	0.0	0.0	0.8
Riparian woodland communities							
Willow-cottonwood riparian woodland[b]	0.0	0.0	0.0	2.8	0.0	0.0	0.0
Mixed riparian woodland	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oak woodland community							
Valley oak woodland	0.0	<0.1	<0.1	<0.1	0.0	0.0	0.0

[a] Each water conveyance alternative includes impacts associated with construction of the conveyance pipeline, Delta intake, transfer reservoir, Los Vaqueros pipeline and electric transmission line.

[b] Under federal jurisdiction pursuant to Section 404 of the Clean Water Act (1977).

Table 7-3. Total Acres of Natural Communities Affected under Each Alternate Los Vaqueros Reservoir Configuration

Natural Community	Rock Slough/ Old River No. 1	Rock Slough/ Old River No. 2	Rock Slough/ Old River No. 3	Rock Slough/ Old River No. 4	Rock Slough/ Old River No. 5	Rock Slough/ Old River No. 6	Rock Slough/ Clifton Court Forebay
Common natural communities							
Grassland community							
Annual grassland	1,050.5	1,080.1	1,009.5	109.5	1,026.5	1,018.5	1,052.8
Oak woodland communities							
Blue oak woodland	35.6	35.6	35.6	35.6	35.6	35.6	35.6
Mixed north slope cismontane woodland	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other habitats							
Dryland farmed grassland	779.1	779.1	779.1	779.1	779.1	779.1	779.1
Agricultural and developed lands	168.2	195.4	292.0	277.0	213.0	252.2	134.0
Alkali wetland communities[a]							
Alkali grassland	20.0	12.5	2.0	2.0	2.0	2.0	15.9
Alkali meadow	3.6	6.4	2.7	5.3	1.9	1.9	4.7
Valley sink scrub	0.0	0.0	0.0	0.0	0.0	0.0	1.8
Alkali marsh/seep	12.4	12.2	12.1	15.6	11.7	12.2	12.4
Northern claypan vernal pool	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	0.8
Riparian woodland communities							
Willow-cottonwood riparian woodland[a]	3.3	3.3	3.3	6.1	3.3	3.3	3.3
Central coast live oak riparian woodland	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Mixed riparian woodland	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Oak woodland community							
Valley oak woodland	180.1	180.1	180.1	180.1	180.1	180.1	180.1
Other waters of the United States							
Stock ponds[a]	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Drainages[a]	1.9	1.9	1.9	1.9	1.9	1.9	1.9

[a] Under federal jurisdiction according to Section 404 of the Clean Water Act.

This configuration also would result in additional losses of significant natural communities, including less than 0.1 acre of alkali grassland, 1.4 acres of alkali meadow, 0.5 acre of alkali marsh/seep, and less than 0.1 acre of valley oak woodland. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration would not affect any special-status plant populations.

Rock Slough/Old River No. 4 Configuration

Natural Communities. This water conveyance configuration would eliminate small additional amounts of common natural communities. These impacts would be less than significant.

This water conveyance configuration also would result in additional losses of significant natural communities, including less than 0.1 acre of alkali grassland, 4.0 acres of alkali meadow, 4.0 acres of alkali marsh/seep, 2.8 acres of willow-cottonwood riparian woodland, and less than 0.1 acre of valley oak woodland. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration would not affect any special-status plant populations.

Rock Slough/Old River No. 5 Configuration

Natural Communities. This water conveyance configuration would eliminate small additional amounts of common natural communities. These impacts would be less than significant.

This configuration also would result in additional losses of significant natural communities, including less than 0.1 acre of alkali grassland, 0.6 acre of alkali meadow, and 0.1 acre of alkali marsh/seep. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration would not affect any special-status plant populations.

Rock Slough/Old River No. 6 Configuration

Natural Communities. This water conveyance configuration would eliminate small additional amounts of common natural communities. These impacts would be less than significant.

This configurations also would result in additional losses of significant natural communities, including less than 0.1 acre of alkali grassland, 0.6 acre of alkali meadow, and 0.6 acre of alkali marsh/seep. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration would not affect any special-status plant populations.

Rock Slough/Clifton Court Forebay Configuration

Natural Communities. This water conveyance configuration would eliminate small additional amounts of common natural communities. These impacts would be less than significant.

This configurations also would result in additional losses of significant natural communities, including 13.9 acres of alkali grassland, 3.4 acres of alkali meadow, 1.8 acres of valley sink scrub, 0.8 acre of alkali marsh/seep, and 0.8 acre of northern clay pan vernal pool. These impacts would be significant.

Special-Status Plant Populations. This water conveyance configuration could eliminate three populations of San Joaquin spearscale totaling 1,150 plants, and three populations of brittlescale totaling 570 plants. These impacts would be significant.

Kellogg Reservoir Alternative

Impacts expected under the Kellogg Reservoir Alternative are presented by project component. Refer to Table 7-4 for a summary of impacts on significant natural communities expected under this alternative.

Potential for Impacts on Botanical Resources in Unsurveyed Portions of the Project Area

As described above for the Los Vaqueros Reservoir Alternative, small portions of utility relocation, water conveyance, and Vasco Road relocation corridors have not been thoroughly surveyed. Although significant impacts could occur in these areas, these impacts could be avoided if facility locations are adjusted to avoid significant natural communities and special-status plant species.

Facility Construction: Dams, Reservoir, and Related Facilities

This section summarizes impacts expected from construction of the Kellogg Reservoir Alternative main dam, saddle dam, and related facilities and from reservoir inundation. Construction materials would be obtained from within the reservoir and from outside sources; thus, impacts resulting from exposed onsite quarry excavation would not occur.

Construction of the dams and related facilities and reservoir inundation would eliminate 1,497.6 acres of annual grasslands, 36.2 acres of blue oak woodlands, 4.8 acres of dryland farmed grasslands, and 25.3 acres of agricultural and developed lands (Table 7-4).

The Kellogg Reservoir Alternative would eliminate 95.5 acres of alkali grasslands, 22.7 acres of alkali meadows, 2.1 acres of valley sink scrub, 7.9 acres of alkali marshes/seeps, 2.9 acres of willow-cottonwood riparian woodlands, and 5.1 acres of valley oak woodlands (Table 7-4). Valley oak woodland losses represent 3% of the total valley oak woodland in the watershed. These woodlands occur in dense, narrow stands along Kellogg Creek. The Kellogg Reservoir Alternative would also eliminate 1.5 acres of stock ponds and 0.5 acre of drainage that qualify as other waters of the United States (Table 7-4).

The Kellogg Reservoir site supports 30 populations of San Joaquin spearscale, consisting of about 86,194 individuals; three brittlescale populations consisting of about 1,500 individuals; and two stinkbell populations consisting of about 1,750 individuals (Figure 7-4).

Facility Construction: Recreation Facilities

The conceptual recreation plan was prepared specifically for the Los Vaqueros Reservoir Alternative. If the Kellogg Reservoir Alternative is implemented, a similar recreation plan would be developed based on the different reservoir location and the recreational opportunities that would be available within the Los Vaqueros Reservoir site. For this impact analysis, impacts on botanical resources are assumed to be similar, regardless of the reservoir site selected, because recreational activities allowed in the watershed would be similar under either alternative and many recreational facilities would likely occupy similar locations, thus affecting similar botanical resources. For a discussion of the expected impacts of recreational facility

Table 7-4. Acres of Natural Communities Affected under the Kellogg Reservoir Alternative

Natural Community	Facility					Total
	Kellogg Reservoir and Related Facilities[a]	Old River No. 5 Water Conveyance Pipeline	Relocated Vasco Road	Natural Gas Pipeline[b]	Electric Transmission Line[b]	
Common natural communities						
Grassland community						
Annual grassland	1,497.6	27.0	152.9	X	X	1,677.5
Oak woodland communities						
Blue oak woodland	36.2	0.0	2.3	X	X	38.5
Central coast live oak woodland	0.0	0.0	0.0	X	X	0.0
Other habitats						
Sandstone outcrop	0.0	0.0	0.0	X	X	0.0
Dryland farmed grassland	4.8	0.0	37.2	X	X	42.0
Agricultural and developed lands	25.3	104.1	0.0	X	X	129.4
Significant natural communities						
Grassland community						
Valley needlegrass grassland	0.0	0.0	0.0	X	X	0.0
Alkali wetland communities[c]						
Alkali grassland	95.5	<0.1	2.0	X	X	97.5
Alkali meadow	22.7	0.6	1.2	X	X	24.5
Valley sink scrub	2.1	0.0		X	X	2.1
Alkali marsh/seep	7.9	0.1	0.2	X	X	8.2
Northern claypan vernal pool	0.0	0.0	<0.1	X	X	<0.1
Intermittent pool community						
Valley rock outcrop intermittent pool community	0.0	0.0	0.0	X	X	0.0

Table 7-4. Continued

Natural Community	Facility: Kellogg Reservoir and Related Facilities[a]	Old River No. 5 Water Conveyance Pipeline	Relocated Vasco Road	Natural Gas Pipeline	Electric Transmission Line	Total
Riparian woodland communities						
Willow-cottonwood riparian woodland[b]	2.9	0.0	0.2	X	X	3.1
Central coast live oak riparian woodland	0.0	0.0	0.0	X	X	0.0
Mixed riparian woodland	0.0	0.0	0.0	X	X	0.0
Oak woodland community						
Valley oak woodland	5.1	0.0	0.1	X	X	5.2
Other waters of the United States						
Stock ponds[a]	1.5	0.0	2.6	X	X	4.1
Drainages[b]	0.5	0.0	0.9	X	X	1.4

Note: X = indicates presence of natural communities and other habitats in generalized study corridors.

[a] Includes the dam, spillway, and Los Vaqueros pipeline.

[b] X indicates the presence of a botanical resource within a generalized study corridor. An accurate assessment of impact acreages cannot be determined in these areas until a specific facility alignment is identified.

[c] Under federal jurisdiction according to Section 404 of the Clean Water Act (1977).

Figure 7-4.
Special-Status Plant Populations Located in the Kellogg Reservoir Inundation Area

LEGEND

ATPA = San Joaquin spearscale *(Atriplex patula ssp.spicata)*

ATDE = brittlescale *(Atriplex depressa)*

FRAG = stinkbells *(Fritillaria agrestis)*

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construction, refer to the "Facility Construction: Recreation Facilities" section for the Los Vaqueros Reservoir Alternative above.

Facility Construction: Water Conveyance Facilities

The Kellogg Reservoir Alternative utilizes only a portion of the Los Vaqueros pipeline. Impacts on botanical resources, therefore, would be less than those reported above in the "Rock Slough/Old River No. 5 Configuration" section for the Los Vaqueros Reservoir Alternative (Figures 7-2 and 7-3). Table 7-4 summarizes the number of affected acres.

Spoil Disposal. Impacts on important botanical resources are not expected from spoil disposal along the water conveyance pipeline corridors because these areas are in agricultural fields and do not support special-status plant species or common or significant natural communities. Reservoir construction requires no spoil disposal sites outside of the inundation zone.

Incidental Construction Impacts

Incidental construction impacts also are possible under this alternative. For a description of possible impacts from incidental construction impacts, refer to the "Incidental Construction Impacts" section the Los Vaqueros Reservoir Alternative above.

Reservoir Operation, Land Management, and Use

Impacts on botanical resources from the future operation, management, and use of the reservoir watershed are the same as described above in the "Reservoir Operation, Land Management, and Use" section for the Los Vaqueros Reservoir Alternative.

Summary of Impacts: Vasco Road and Utility Relocation. This section discusses the impacts of natural gas pipeline, and electric transmission line relocations associated with the Kellogg Reservoir Alternative. Impacts for Vasco Road are identical to those presented above in the "Summary of Impacts: Vasco Road and Utility Relocation" section for the Los Vaqueros Reservoir Alternative. Refer to the Vasco Road and Utility Relocation Project EIR for locations of botanical resources along relocation corridors. The existing petroleum pipeline would not require relocation under this alternative.

Small portions of natural gas and electric transmission line corridors associated with the Kellogg Reservoir Alternative remain unsurveyed. Impact assessments for these areas were based on aerial photograph interpretation and vegetation maps. A potential to disturb special-status plant species was assumed if suitable habitat occurred in unsurveyed areas. The following discussion describes only the presence or absence of botanical resources in the broad study corridors because final specific alignments have not been identified for these relocations.

The utility relocations would disturb or eliminate only small portions of the habitat in the study corridors. Consequently, botanical resources found in utility corridors would not necessarily be affected by the project. As described for the Los Vaqueros Reservoir Alternative, many opportunities exist during final design to avoid impacts on botanical resources; thus, utility relocation impacts would be unlikely.

Electric transmission line corridors contain common natural communities consisting of annual grasslands with scattered sandstone outcrops and a few blue oak woodlands. Electric transmission line study corridors contain the following significant natural communities: valley needlegrass grasslands; alkali grasslands; alkali meadows and marshes/seeps; valley rock outcrop intermittent pools; willow-cottonwood and central coast live oak riparian woodlands; and valley oak woodlands. The natural gas pipeline corridor

contains annual grasslands, blue oak woodlands, live oak woodlands, and scattered sandstone outcrops (Table 7-4).

Natural gas pipeline corridors cross one small alkali marsh, two live oak riparian woodlands along intermittent streams, and two alkali wetland complexes.

Summary of Impacts and Conclusions of Significance. The following discussion summarizes expected impacts of the Kellogg Reservoir Alternative. The number of acres affected are summarized in Table 7-4.

Impacts on Botanical Resources in Final Facility Locations and in Unsurveyed Portions of the Project Area. Impacts on botanical resources in unsurveyed portions of the project area and in generalized facility locations would be unlikely because ample opportunities exist to avoid botanical resources during facility design. However, if impacts on significant natural communities or special-status plant species were unavoidable, the impacts would be significant.

Loss of Common Natural Communities and Other Habitats. The loss of 1,677.5 acres of annual grasslands, 42.0 acres of dryland farmed grasslands, and 129.4 acres of agricultural lands (Table 7-4) would be less than significant because these communities are relatively abundant in the region and do not support special-status plant species or other important botanical resources. Loss of 38.5 acres of blue oak woodlands would be less than significant for the reasons stated above under "Loss of Common Natural Communities and Other Habitats" for the Los Vaqueros Alternative.

Loss of Significant Natural Communities and Jurisdictional Wetlands. Implementing this alternative would eliminate 97.5 acres of alkali grasslands, 24.5 acres of alkali meadows, 2.1 acres of valley sink scrub, 8.2 acres of alkali marshes, 0.01 acre of northern claypan vernal pool, 3.1 acres of willow-cottonwood riparian woodlands, and 5.2 acres of valley oak woodlands, (Table 7-4). Each of these impacts would be significant for the reasons listed above under "Criteria for Conclusions of Significance".

The loss of 5.2 acres of valley oak woodlands represents 3% of the total valley oak woodland occurrences in the Kellogg Creek watershed and a minor portion of the remaining occurrences in Contra Costa County.

Loss of Other Waters of the United States. The Kellogg Reservoir Alternative would eliminate 4.1 acres of stock ponds and 1.4 acres of drainages (Table 7-4). The loss of these habitats would be a less-than-significant impact, as discussed for the impacts of the Los Vaqueros Reservoir Alternative that are common to all alternate configurations. Refer to the section entitled "Loss of Other Waters of the United States" above.

Loss or Fragmentation of Special-Status Plant Populations. The Kellogg Reservoir Alternative would affect three populations of San Joaquin spearscale, eliminating an estimated 86,194 plants; three populations of brittlescale, totaling 1,500 plants; and two populations of stinkbells, eliminating an estimated 1,750 plants (Figure 7-3). Each of these impacts would be significant for the reasons listed above under "Criteria for Conclusions of Significance".

Desalination/EBMUD Emergency Supply Alternative

Impacts expected from construction of the desalination plant and brine disposal pipeline are described below and summarized in Table 7-5. This distribution of botanical resources in and near project impact areas is presented in Figure 7-5.

Table 7-5. Acres of Natural Communities Affected by Construction of the Desalination/EBMUD Emergency Supply Alternative

Natural Community	Water Conveyance Facility				Total
	Desalination Plant[a]	Brine Disposal Pipeline	Rock Slough Intake Channel	EBMUD Intertie Pipeline	
Common natural communities					
Grassland community					
Annual grassland	0.0	0.0	5.7	12.6	18.3
Other habitats					
Dryland farmed grassland	0.0	0.0	0.0	4.8	4.8
Agricultural and developed lands	99.4	4.6	0.0	46.8	150.8
Significant natural communities					
Brackish marsh community					
Brackish marsh[b]	0.0	6.7	0.0	0.0	6.7

[a] Desalination plant includes solids lagoon.
[b] Under federal jurisdiction pursuant to Section 404 of the Clean Water Act (1977).

Facility Construction: Desalination Plant

Constructing the desalination plant would eliminate up to 99.4 acres of fallow agricultural fields (Table 7-5), but would not affect common natural communities, significant natural communities, jurisdictional wetlands or other waters of the United States, or special-status plant species.

Facility Construction: Brine Disposal Pipeline and Associated Water Conveyance, Intake, and Electric Transmission Line Facilities

The brine disposal pipeline is located primarily in the SR 4 right-of-way, and thus would not affect botanical resources in these areas. At the eastern end, the pipeline would eliminate 51.4 acres of agricultural fields, 18.3 acres of annual grasslands, 4.8 acres of dryland farmed grasslands. At the northwestern end near Pittsburg, the pipeline would disturb 6.7 acres of a brackish marsh (Figure 7-5, Table 7-5). Constructing a buried pipeline in this area could result in additional incidental construction impacts on this wetland community. A pipeline in this area could eliminate or degrade additional acreage of brackish marsh if it led to erosion or separated the marsh from tidal inundation by the Sacramento-San Joaquin River.

Field surveys of the northwestern portion of this study corridor failed to locate any special-status plant species.

Spoil Disposal

Spoil disposal sites have not yet been identified under this alternative; however, the selected site would likely be on agricultural lands or fallow fields. Impacts on botanical resources are possible, depending on which site is selected, but are unlikely because of the flexibility in site selection. If special-status species or significant natural communities were eliminated, degraded, or fragmented by spoil disposal, the impact would be significant.

Summary of Impacts and Conclusions of Significance

The Desalination/EBMUD Emergency Supply Alternative is expected to eliminate 18.3 acres of annual grasslands, 4.8 acres of dryland farmed grasslands, and 150.8 acres of agricultural and developed lands (Table 7-5). This impact would be less than significant because these areas do not support any botanical resources. Elimination of 6.7 acres of brackish marsh would be significant because this community is regionally limited and the marsh is a jurisdictional wetland. Impacts on special-status plant species are unlikely because special-status species were not located during field surveys.

Spoil disposal sites have not been identified under this alternative. Impacts on special-status plant populations or significant natural communities would be unlikely because of avoidance opportunities during site selection. Impacts would be significant if special-status species or significant natural communities were eliminated or degraded.

Middle River Intake/EBMUD Emergency Supply Alternative

Facility Construction: Water Conveyance, Intake, and Electric Transmission Line Facilities

The following discussion summarizes the occurrences of common natural communities, significant natural communities, and special-status plant species located in areas potentially affected by construction of a water conveyance pipeline, intake site, electric transmission lines, and transfer reservoir pumping plant.

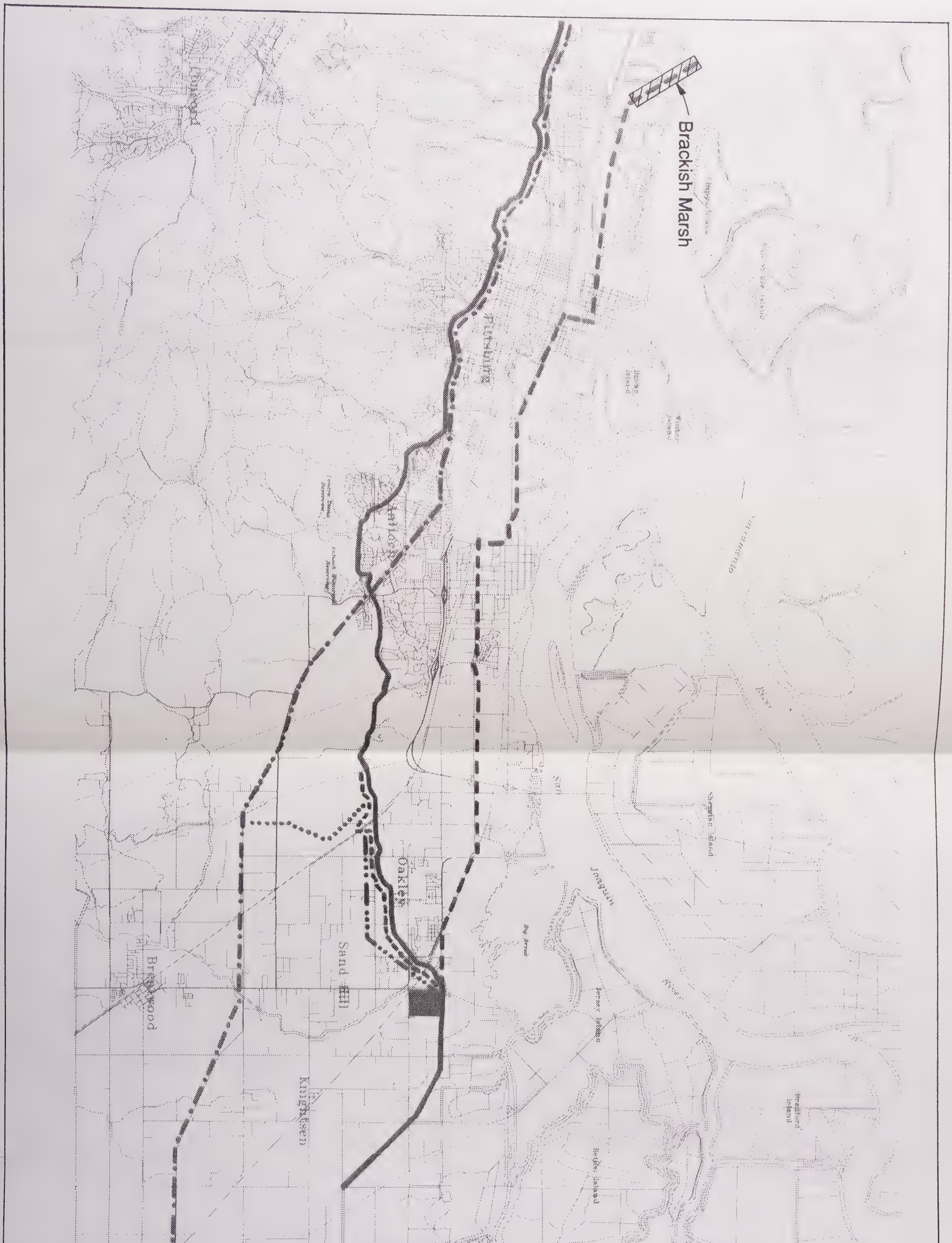


Figure 7-5. Significant Natural Communities in the Vicinity of the Desalination/EBMUD Emergency Supply Alternative Facilities

The 400-foot-wide pipeline corridors that were evaluated provide flexibility to site facilities to avoid significant impacts. Therefore, constructing the pipeline component would affect only a small portion of the botanical resources located in the corridor.

Approximately 27.3 acres of annual grasslands and 239.2 acres of agricultural and developed lands occur in the water conveyance corridor and related facility sites (Figure 7-6, Table 7-6).

The water conveyance, intake, and electric transmission line corridor and related facilities support 0.2 acre of alkali grasslands, 0.3 acre of alkali meadows, 0.3 acre of alkali marshes/seeps, and 0.1 acre of mixed riparian woodlands (Table 7-6).

The water conveyance corridor and related facilities do not support special-status plant species.

Spoil Disposal

Impacts on botanical resources from spoil disposal are the same as described under "Spoil Disposal" in the "Desalination/EBMUD Emergency Supply Alternative" section above and are thus unlikely.

Incidental Construction Impacts

Incidental construction impacts, if they occurred, would add to those described above and would be significant if they resulted in the permanent loss of special-status plant species or the loss or degradation of significant natural communities.

Summary of Impacts and Conclusions of Significance

The loss of annual grasslands and agricultural and developed lands would be a less-than-significant impact. Loss of alkali wetland communities represents a significant impact.

MITIGATION MEASURES

Definitions

The following defined terms are used throughout the "Mitigation Measures" section.

Creation

Creation is the establishment of a plant community in an area that did not previously support it. For example, by implementing techniques such as grading, installing check dams, and inoculating land with seed and soil from disturbed wetlands, wetland communities can be created on upland sites that lack wetland vegetation and hydrology.

In-kind/like-value creation is the establishment of the same habitat that would establish the same type of ecological values over time as the affected habitat. For example, creating an artificial vernal pool with species similar to those found in an affected vernal pool would be in-kind/like-value creation.

Table 7-6. Acres of Natural Communities Affected by Construction of the Middle River Intake/EBMUD Emergency Supply Alternative

Natural Community	Facility: Middle River Pipeline and Related Facilities[a]	Facility: Transmission Line-Old River Alignment at PG&E	Total
Common natural communities			
Grassland community			
Annual grassland	27.3	0.0	27.3
Other habitats			
Agricultural and developed lands	204.3	34.9	239.2
Significant natural communities			
Alkali wetland communities[b]	0.2		
Alkali grassland	0.3	0.0	0.2
Alkali meadow	0.3	0.0	0.3
Alkali marsh/seep		0.0	0.3
Riparian woodland communities			
Mixed riparian woodland	0.1	0.0	0.1

[a] Middle River pipeline and related facilities includes intake, Orwood Pumping Plant, Neroly blending facility, and EBMUD intertie pipeline.

[b] Under federal jurisdiction pursuant to Section 404 of the Clean Water Act (1977).

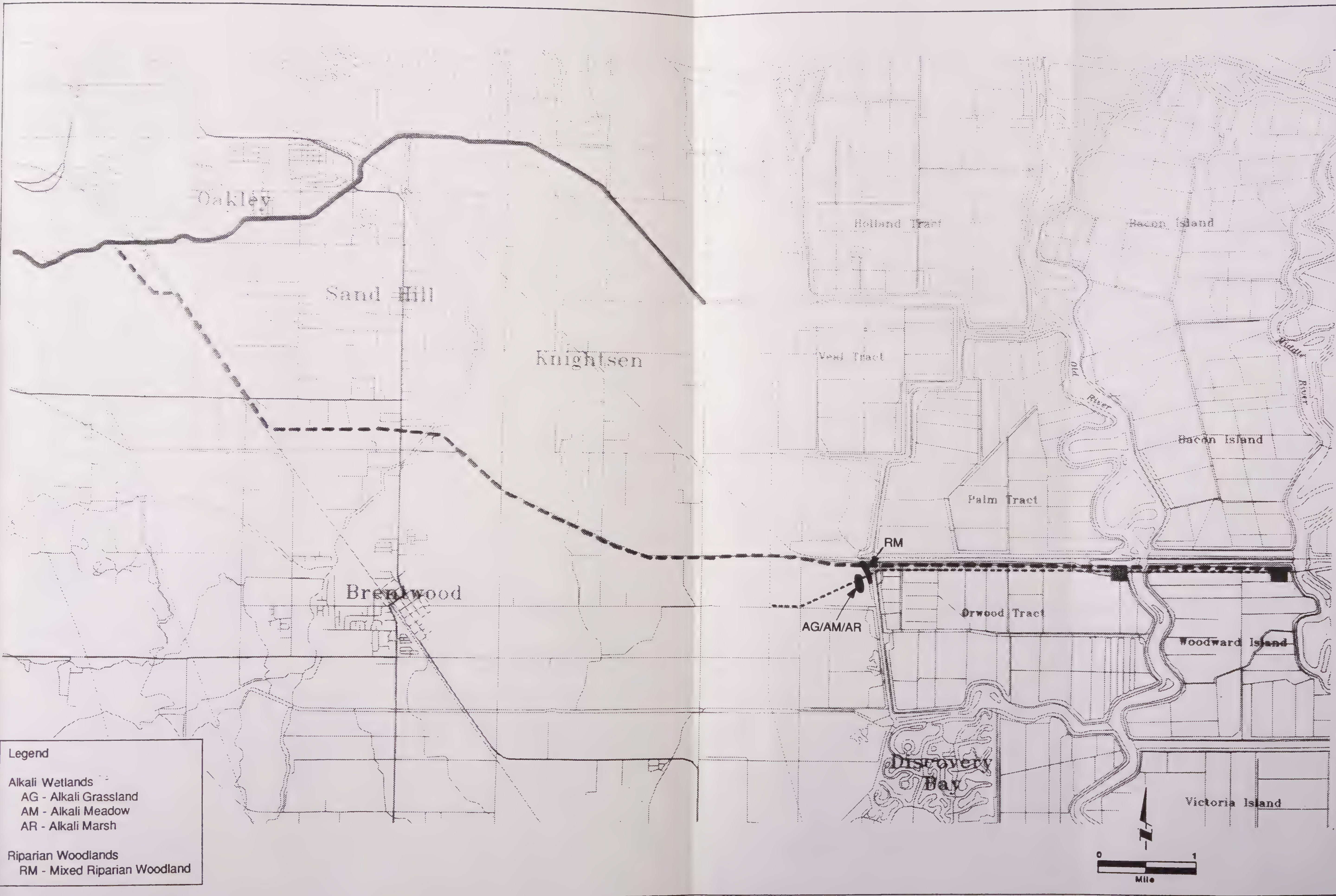


Figure 7-6. Significant Natural Communities in the Vicinity of the Middle River Intake/EBMUD EmergencySupply Alternative Facilities

Out-of-kind/like-value creation is the establishment of similar, but not identical, habitat with some of the same ecological values as the affected habitat over time. For example, creating a shallow pond that supports the same species and provides a similar source of seasonal water for wildlife as the affected vernal pool would be considered out-of-kind/like-value creation. Although the replacement habitat is not identical, it provides similar values, such as water for wildlife and habitat for vernal pool species; however, on a per-acre basis, the amount of values provided are lower.

Enhancement

Enhancement is the improvement of an existing degraded plant community. Enhancement involves improving one or more existing ecological factors, such as species richness, species diversity, overall vegetative cover, aerial extent, value to wildlife, hydrological functioning, and water storage capabilities. An example of enhancement would be planting seedlings in an existing valley oak woodland stand to increase the aerial extent, value to wildlife, density, and age-class structure.

Restoration

Restoration is the establishment of a plant community in an area that historically supported it, but no longer supports the community because of the loss of one or more ecological factors required to support the resource. For example, vernal pools could be restored in a plowed field that historically supported the resource, but that no longer has the soil characteristics or hydrological functioning to support vernal pools. In this case, restoration could involve installing check dams, improving soil water-holding capacities, and inoculating the area with vernal pool plant seeds. Restoration can be considered an extreme form of enhancement.

Mitigation Measures Common to All Alternatives

Potential Impacts on Botanical Resources in Final Facility Locations and Unsurveyed Portions of the Project Area

7-1: Conduct Site-Specific Surveys and Wetland Delineations. Small portions (approximately 20 acres) of the petroleum pipeline and relocated Vasco Road corridor are unsurveyed. Site-specific surveys should be performed for any unsurveyed areas in the final facility locations before construction.

Site-specific surveys and wetland delineations may also be required for project features that have been surveyed generally but which lack a specific facility location (e.g., water conveyance facilities and recreation facilities). Additional site-specific surveys would be conducted to precisely quantify any unavoidable impacts on special-status plant species, significant natural communities, and jurisdictional wetlands and other waters of the United States. A detailed wetland delineation must be prepared and verified by the Corps before a permit under Section 404 of the Clean Water Act can be obtained.

If site-specific surveys reveal the presence of special-status plant species, significant natural communities, or jurisdictional wetlands or other waters of the United States, efforts to avoid these resources should be pursued. If avoidance is infeasible, the appropriate mitigation measures described below should be implemented.

Disturbance of Common Natural Communities and Other Habitats during Construction

7-2: Restore Disturbed Sites. Where possible, sites disturbed during facility construction should be restored to preconstruction conditions to prevent impacts on adjacent botanical resources. Disturbed areas should be treated as follows:

- Natural land contours and slopes should be reestablished, where possible, using soil salvaged from the site.

- Disturbed areas should be reseeded to the extent practicable, emphasizing the use of plant species naturalized to the immediate region that originally occurred at the site. For example, in disturbed annual grasslands, use of non-native species should be limited to those currently naturalized and widespread in the immediate region, such as Zorro fescue, soft chess, certain clover species, and other species that do not threaten the structure or composition of the existing natural community.

Where appropriate, a restoration plan should be prepared in conjunction with the appropriate agencies. The plan should include specific measures to control erosion and sedimentation.

7-3: Avoid or Minimize Loss of Oak Woodlands during Construction and Final Facility Siting. Impacts on blue oak woodlands, live oak woodlands, and mixed north slope cismontane woodlands could occur in final facility locations or as a result of incidental construction impacts in areas adjacent to construction sites. Impacts can be mitigated in these areas by avoiding oak woodlands by relocating facilities during design and site selection processes. Where avoidance is infeasible, impacts on oak woodlands should be minimized during facility design.

7-4: Protect Oak Woodlands from Construction Impacts. The following guidelines are designed to protect oaks and oak woodlands during and after project construction. These guidelines are intended to prevent significant incidental construction impacts on oak woodlands. Specific measures to compensate for unavoidable impacts on oak woodlands are described in later sections.

- Flag all trees to be retained in the construction zone before construction or grading. A 6-foot-high fence shall be installed 2 feet beyond each tree's dripline (the radius of a tree as measured from the branch that extends farthest from the trunk).

- Minimize paving and soil compaction within the oak tree dripline resulting from such activities as storing construction materials, parking vehicles, or gaining access to construction sites with heavy machinery. If paving is required, porous or other materials requiring minimal compaction shall be used. Where soil compaction occurs, soil permeability and root aeration shall be restored as directed by a qualified arborist.

- Minimize soil surface removal and cut or fill activities within tree driplines. If cuts or fills are required within a tree dripline, supplemental drainage or irrigation and root aeration should be provided as necessary to prevent loss of the affected trees.

- Minimize trenching to install underground utilities within tree driplines. When feasible, trenches shall be bored or drilled a minimum of 2 feet from the tree dripline.

- Minimize irrigation within tree driplines. Prevent unnatural water sources from entering oak woodlands during the dry season, typically June to October. Only plant species that do not require irrigation and nonplant materials, such as gravel and wood chips, shall be used for landscaping within driplines.

Loss or Degradation of Alkali Wetlands

Mitigation measures to reduce impacts on alkali wetlands to less-than-significant levels are listed below in order of preference. It may be necessary to use one or more measures to achieve full mitigation because individually, some measures cannot fully mitigate impacts, or may not be practical in a given situation.

7-5: Avoid or Minimize Loss of Alkali Wetlands. Impacts on alkali wetland communities located in generalized facility locations should be fully avoided or reduced to the maximum extent practicable by relocating facilities outside of these alkali wetlands. For example, during the engineering design process for relocating Vasco Road, CCWD has rerouted the road alignment to avoid many wetland areas. The same procedure has been conducted for natural gas and petroleum pipelines, water conveyance pipelines, and electric transmission line relocations, and will be conducted for recreation facilities. Although refining facility locations may substantially reduce the amount of wetlands affected, it will not reduce impacts to less-than-significant levels. Measures necessary to compensate for unavoidable alkali wetland losses are therefore described below.

7-6: Compensate for Unavoidable Alkali Marsh Losses

Mitigation Goal. The mitigation goal established by the Corps and EPA (54 FR 51319, December 14, 1989) to compensate for the unavoidable loss of wetlands or other waters of the United States is to provide no net loss of habitat acreage and values.

The no-net loss goal for alkali marsh can be reasonably ensured through in-kind replacement of lost acreages and values. Alkali marshes similar to those in the project area have been successfully created in California, and have formed naturally in stock ponds throughout the region.

Mitigation Objectives. Mitigation objectives (i.e., the number of acres of replacement alkali marsh habitat required to compensate for lost alkali marsh habitat) will be established based on the acreage and values of each affected alkali marsh. Mitigation requirements for project components without final facility locations should be determined based on the results of additional site-specific surveys, as described above under "Conduct Site-Specific Surveys" and wetland delineations.

The final mitigation objectives are expected to exceed a ratio of 1 replacement acre for each affected acre for the following reasons:

- a 100% success rate cannot be guaranteed in the replacement habitat,
- a lag time exists between the loss of the affected habitat and the point at which the replacement habitat provides full values, and
- additional compensation may be required if the replacement habitat is of lower quality than the affected habitat.

Mitigation objectives would be established by comparing the baseline conditions of the affected habitat with those at the mitigation site. This habitat evaluation should employ a quantitative approach, which compares ecological values eliminated with those expected after mitigation. The evaluation would assess:

- **Plant species richness.** This value measures the ability of a habitat to support a rich assemblage of native halophytes.
- **Habitat diversity.** This value measures the ability of microhabitats to provide the range of conditions required to support all dependent plant and wildlife species.

- **Vegetative cover.** This value measures the ability of vegetative biomass to protect soils from erosion and provide the primary productivity that drives food webs.

- **Surface water.** This value reflects the importance of temporary flooding and ponding in habitats for hydrophytic species, as a source of water for wildlife for groundwater recharge, and for attenuation of peaks in surface runoff during storms.

- **Intrinsic social value.** This value reflects the scientific and aesthetic attributes of a habitat. Values may include knowledge of plant and animal adaptations to the harsh environment of seasonal alkali wetlands; the species' evolution, biogeography, and methods of seed dispersal; and the soil and landform genesis. Aesthetic value may include wildflower displays, intrinsic beauty of the habitat, and values associated with open space.

Values should be assigned numerical values (i.e., a range of 0 for highly disturbed or degraded conditions to 3 for pristine, high-quality conditions). The final habitat evaluation scores could be summed for each site and used to:

- quantify mitigation objectives on a site-specific basis based on condition,

- determine the amount of compensation that could be achieved at a mitigation site, and

- assess success of the mitigation effort in achieving the no-net loss goal for acreages and values.

Once replacement and impact sites are evaluated, final mitigation objectives would be determined.

Mitigation sites should be located as close as possible to the affected site. For example, alkali marsh occurring along a drainage that will be realigned should be mitigated by establishing similar habitat along the newly aligned drainage channel. Channels should be designed to accommodate acreage equal to or greater than that eliminated. Mitigation plantings should only include species that occur naturally in the region's alkali marshes and should utilize planting stock either salvaged from the affected site or from similar local sources. Alkali marshes associated with stock ponds, and any alkali marsh losses along realigned drainages not fully compensated for, should be mitigated by creating stock ponds with banks that allow the establishment and perpetuation of marsh vegetation. A reliable source of water, proper levels of grazing, and protection in perpetuity would also have to be provided to fully mitigate significant impacts.

Mitigation Techniques. A combination of in-kind/like-value creation and enhancement would be employed to compensate for impacts on alkali marsh.

Success Criteria. Success would be measured by comparing the created habitats with undisturbed (ungrazed) "reference" habitats that have the same function in the project vicinity. Success would involve two components: create a self-sustaining ecosystem that requires little or no long-term intervention or management and provide similar habitat values in the created habitats, as measured by successful establishment of vegetation and invertebrate fauna. Success would be achieved when created habitats attain the following characteristics when compared with reference habitats: total vegetative cover exceeds 80% of the amount of cover at the reference sites, and 80% or more of the vegetative cover and greater than 50% of the invertebrate fauna are comprised of the dominant and characteristic species in reference habitats.

Monitoring. The mitigation plan should be monitored during the spring and summer growing season to track the progress of mitigation, determine necessary corrective measures to remedy undesirable trends, and gather data to determine if success is achieved. If success is not achieved after 5-7 years, enhancement of nearby degraded sites and out-of-kind compensation (described below) should be required to mitigate significant impacts.

Success would be monitored by comparing the dominant species (plants comprising over 20% relative cover and invertebrates comprising over 20% of the total number of individuals) and characteristic species (i.e., indicator species that occur regularly in a habitat but at low frequency) in created habitats with those at the reference site.

Site-Specific Mitigation Plan. A site-specific mitigation plan should be developed for alkali wetlands, which includes alkali marsh, based on the mitigation goal and objectives discussed above.

The mitigation plan should specify mitigation techniques and expected results; a schedule and cost estimate; management and monitoring requirements; the species, type, and location of planting stock collection; the location and method of planting; specific criteria for success; and remedial measures to be employed if necessary to ensure success.

Availability of Mitigation Sites. A preliminary analysis indicates that numerous sites exist that may be suitable as alkali marsh mitigation sites. Ample opportunities exist in the Kellogg Creek watershed, the Herdlyn watershed, and along the realigned segments of Brushy Creek. These mitigation sites are preferred because they are close to the expected impact area, are already owned by CCWD, and are relatively large and contiguous with other alkali marsh occurrences.

Several mitigation sites outside the Kellogg Creek watershed could also provide mitigation opportunities. Numerous suitable sites occur in the Kellogg Creek and Herdlyn watersheds, south and east of Byron Hot Springs and the town of Byron, near Byron Airport, and adjacent to the Delta Fish Facility. Although offsite compensation is not preferred, these sites could provide additional mitigation to ensure success of the mitigation effort.

7-7: Compensate for Unavoidable Alkali Grassland and Alkali Meadow Losses

Mitigation Goal. The unavoidable loss of alkali grasslands and alkali meadows should be mitigated to less-than-significant levels by replacing the lost habitat acreage and values.

Mitigation Objectives. To achieve full compensation, separate mitigation objectives should be developed for habitat acreage and habitat values. Separation of these two characteristics is required because in-kind/like-value creation is considered infeasible and impractical for the following reasons:

- creation of alkali grassland and meadows has never been successfully attempted and is thus considered highly experimental;

- in-kind/like-value creation is considered infeasible from an engineering and construction standpoint because of the complexity of these habitats; and

- All suitable mitigation sites, other than those eliminated by the project, already support alkali wetlands.

Consequently, loss of alkali grasslands and alkali meadows should be mitigated by creating out-of-kind/like-value habitat and acquiring, enhancing, and restoring in-kind degraded habitats.

Full compensation is expected to require more than 2 acres of created, enhanced, or restored habitat for every acre eliminated. Final mitigation objectives would be determined by conducting a quantitative analysis of the affected wetlands similar to that described above under "Compensate for Unavoidable Alkali Marsh Losses". Baseline conditions at the affected wetlands would be compared to wetland values that could be created, enhanced, or restored at any given mitigation site. The final compensation plan should specify the number of acres of out-of-kind/like-value creation, restoration, or enhancement required to offset lost habitat acreages and values.

As described for alkali marsh, mitigation sites should be located as close as possible to the affected site. A reliable source of water and protection in perpetuity would also have to be provided to fully mitigate significant impacts.

Mitigation Techniques. A combination of out-of-kind/like-value creation and acquisition and enhancement or restoration would be employed to fully compensate loss of alkali grassland and alkali meadow habitats. Out-of-kind/like-value creation would be undertaken to compensate for lost acreage and to partially compensate for lost habitat values. Residual lost values would be mitigated by acquiring and enhancing or restoring habitat similar to the affected habitat.

Out-of-kind/like-value wetlands should be created at sites near the project area that have soil with elevated salinity and alkalinity but are not wetlands. To reduce site drainage, wetland creation sites should be graded to make shallow impoundments over large, flat areas using low 1- to 2-foot berms. Soil should be augmented as necessary to reduce water infiltration rates and capacity; however, many local candidate sites have heavy clay soil that does not need augmenting. After suitable soil and topography are established, the site should be inoculated with seed and rhizomes in topsoil salvaged from eliminated habitat.

Acquisition and enhancement or restoration of in-kind habitat acreages would not alone mitigate significant impacts on alkali meadows or alkali grasslands to a less-than-significant level because a net loss of habitat acreage would still occur. However, acquisition and enhancement or restoration, combined with out-of-kind/like-value creation, could fully mitigate lost habitat values and acreages.

Acquisition and enhancement could recover habitat values of degraded wetlands by improving water storage capabilities, species richness, species diversity, and overall wetland extent. Enhancement or restoration techniques could include modifying land management practices to reduce grazing pressures (i.e., reducing stocking levels, changing livestock distribution patterns, or changing the duration or timing of grazing); installing check dams, rechanneling eroded or downcut creeks, and reducing headwall erosion; installing livestock exclosures; or reseeding to increase species richness and diversity.

Success Criteria. Success for out-of-kind/like-value creation would be measured by comparing the wetland habitat acreage values achieved at the created habitat with the wetland habitat acreage values eliminated at the affected habitat. Successful acreage compensation is achieved when the created habitat equals or exceeds the acreage of the affected habitat.

Successful habitat value compensation for out-of-kind/like-value creation would require that the created habitat achieve a similar number of wetland habitat value "units" as the affected habitat. This evaluation would be based on the numerical assessment method described above under "Mitigation Objectives". A numerical value would be assigned to habitat value parameters. The habitat value of the created habitat then could be quantified and compared with the value units lost at the affected habitat.

Created habitats should have the following characteristics, when compared with an in-kind reference habitat: a total vegetative cover exceeding 80% of the vegetative cover observed at the reference habitat and at least 80% of dominant plant species and at least 50% of invertebrate fauna observed at the created site should be comprised of dominant and characteristic species found at the reference habitat.

Enhancement or restoration would be considered successful when the vegetative cover, plant species diversity, overall species diversity, water storage capabilities, hydrological functioning, and overall extent of a degraded habitat improved.

Both created and enhanced out-of-kind/like-value habitats would have to be self-sustaining, require little or no management or other human intervention, and be provided protection in perpetuity to achieve success.

Monitoring. Both created and restored or enhanced habitats should be monitored in a manner similar to the approach outlined above under "Compensate for Unavoidable Alkali Marsh Losses".

Site-Specific Mitigation Plan. As described above under "Compensate for Unavoidable Alkali Marsh Losses", a site-specific mitigation plan should be developed for alkali wetlands, which includes alkali grasslands and alkali meadows. Refer to this section for specifics of this plan.

Availability of Mitigation Sites. Ample opportunities out-of-kind/like-value creation and enhancement or restoration in the Kellogg Creek watershed and along the relocated segment of Vasco Road. Use of these sites is considered advantageous, as described above under "Compensate for Unavoidable Alkali Marsh Losses". In addition, numerous other options are available for each mitigation technique.

A reconnaissance of the general region of the project area has revealed the presence of several sites that could be satisfactory for creating alkali wetlands. These sites are devoid of wetlands (except for narrow stringers along creeks), have level to gently sloping topography, and are located at canyon mouths or in wide-bottomed valleys. Potential sites include the Los Vaqueros and Herdlyn watersheds, Brushy Creek Canyon, the Kellogg Creek watershed near Marsh Creek Road, and near the Byron Airport and City of Byron, along several tributaries to Brushy Creek.

7-8: Compensate for Unavoidable Northern Claypan Vernal Pool Losses

Mitigation Goal. The mitigation goal to compensate for the unavoidable loss of northern claypan vernal pools is to provide no-net loss of habitat acreage and values.

This goal could be accomplished through in-kind replacement of lost acreage and values. Vernal pool creation projects have been required by the Corps as a condition of Section 404 permit approval. These artificial vernal pools have not been under evaluation long enough to determine if they can successfully recover all eliminated resource values. Initial indications show that basins can be created to replicate the seasonal hydrology of vernal pools and sustain populations of some vernal pool plants and invertebrates, thereby recovering some habitat values of natural vernal pools.

Mitigation Objectives. Mitigation objectives should employ a similar approach as that described above under "Compensate for Unavoidable Alkali Marsh Losses". Final mitigation objectives are expected to equal or exceed 2 replacement acres for every affected acre to compensate for the uncertainties associated with vernal pool creation and to ensure recovery of habitat values.

Mitigation Techniques. A combination of in-kind/like-value creation and acquisition and enhancement would be employed to compensate for impacts on northern claypan vernal pools. The concepts of a plan to create vernal pools would employ the same general steps as described above for alkali marshes. In addition, techniques to maintain ponding in vernal pool basins should be employed. Vernal pools created for mitigation purposes should be interspersed within an alkali grassland and meadow habitat mosaic to reflect natural conditions.

Success Criteria. Success should be determined using the same objectives and parameters described above for alkali marshes. Plant cover and hydrologic behavior of the created pools should be within the range of variation measured in reference pools.

Monitoring. As described above under "Compensate for Unavoidable Alkali Marsh Losses", the artificial vernal pools should be monitored after construction to characterize the vegetation, track the patterns and rates of establishment, identify problem areas where further intervention could be necessary, and determine if the habitat was created successfully.

Site-Specific Mitigation Plan. As described above under "Compensate for Unavoidable Alkali Marsh Losses", a site-specific mitigation plan should be developed for northern claypan vernal pools. Refer to this section for the specifics of this plan.

Availability of Mitigation Sites. Mitigation sites for vernal pool creation would be the same as those described for alkali grasslands and alkali meadows. Refer to the section above entitled "Compensate for Unavoidable Alkali Grassland and Alkali Meadow Losses".

A preliminary analysis reveals the presence of several sites available for restoration and enhancement. Degraded vernal pools are known to occur at sites near Byron Airport and the Delta Fish Facility.

7-9: Prevent Hydrological Modification of Alkali Wetlands. Maintaining the hydrology of wetlands near construction zones should be a primary concern. Best management practices should be employed to minimize erosion upslope from alkali wetland communities. Access roads, equipment staging areas, and temporary spoil disposal sites should be positioned to avoid affecting these resources (e.g., position downslope).

The feasibility and practicality of management practices should be taken into account. If such measures are infeasible, or if the mitigation proves unsuccessful, reduced alkali wetland acreage resulting from hydrological modifications should be added to the projectwide losses and mitigated as described above under "Compensate for Unavoidable Alkali Grassland and Alkali Meadow Losses".

Loss of Riparian Woodlands

7-10: Compensate for Willow-Cottonwood, Mixed, and Central Coast Live Oak Riparian Woodland Losses. A combination of restoration and enhancement of degraded willow-cottonwood, mixed, and central coast live oak riparian woodlands should be used to compensate for the minor loss of these communities that would result from implementing this project. Restoration should occur as close as possible to the impact areas, preferably along the same drainage that would sustain the impact.

Compensation for riparian woodland losses would follow the approach outlined above for oak woodland losses. Refer to the discussion presented below under the "Compensate for Unavoidable Valley Oak Woodland Losses" section of the Los Vaqueros Reservoir Alternative. The ratio of compensation acreage for each acre of affected habitat would likely equal or exceed 2 treated acres for each affected acre. The ratio of trees planted for each tree eliminated would be determined on a site-by-site basis to ensure long-term replacement of lost trees. A ratio of three trees planted for each tree eliminated may be required to recover lost habitat values more rapidly. A revegetation plan prepared by a qualified restoration ecologist and reviewed by the appropriate agencies should specify the form and size of planting stock appropriate for the region and employ the most successful techniques available at the time of planting. For example, rooted live oaks and containerized stock of cottonwoods and willows are probably appropriate. Saplings should be placed so that, when mature, the stand would replicate the natural structure of similar riparian woodlands in the region.

Success criteria should be developed as described below in the "Compensate for Unavoidable Valley Oak Woodland Losses" section of the Los Vaqueros Reservoir Alternative. Plantings should be monitored semiannually for a minimum of 5 years to ensure that plants have established successfully. Riparian woodlands would be considered successfully created when sapling trees are established, no longer require active management, and are arranged in groups that, when mature, will replicate the area, natural structure, and species composition of similar habitats in the region.

Loss of Special-Status Plant Species

7-11: Compensate for Loss of Special-Status Plant Populations. The elimination of an entire special-status plant species population is an unmitigable impact unless it is possible to establish a new, self-sustaining population. Although conceptually possible, attempts to establish new populations generally have not been successful (Fahselt 1988). Some initial success in establishing new populations of large-flowered fiddleneck has occurred (Pavlik pers. comm.), but the long-term sustainment of the newly established population is unknown. Establishing new populations of brittlescale, San Joaquin spearscale, Mount Diablo manzanita, or Brewer's dwarf flax populations has not been attempted.

An attempt to establish a stinkbells population near Livermore was initiated in 1989 (Hartefgeldt pers. comm.). The results of this attempt have not been documented and the experiment is in an early stage, so an assessment of long-term sustainment is unavailable.

Mitigating the loss of an entire special-status plant species population would require successful establishment of one self-sustaining replacement population for each eliminated population. A detailed mitigation plan should be developed by a qualified restoration specialist according to DFG guidelines and in cooperation with DFG and USFWS. The following steps should be included in such a plan:

- Seed should be salvaged from the disturbed population and assessed for viability. If sufficient viable seed cannot be gathered from the disturbed population, an alternate source should be considered.

- The vegetation, hydrology, topography, and other descriptive microhabitat features should be characterized in the area of the disturbed population and other populations in the region.

- The seed germination requirements of the species should be characterized using field and laboratory studies.

- Optimal habitat for the plant species should be described based on the above information.

- Information describing optimal habitat should be used to identify candidate sites for introduction.

- Candidate sites should be surveyed to determine if special-status plant species occur at the site. Sites occupied by special-status plant species should not be considered suitable candidate sites for mitigation planting.

- A screening process to select introduction sites should be developed to rank potential candidates, based on suitability for the target species, habitat quality, and site defensibility and preservability.

- Seed should be transplanted to the introduction sites; information on germination requirements and microhabitat preferences of the species should be used to guide the effort.

- A pilot study should be used to evaluate the plan's feasibility before embarking on a full-scale introduction effort.

To fully mitigate the significant impact, any newly established population should be protected in perpetuity through purchase of fee title or conservation easement. Title should be transferred to a nonprofit land management entity that could include CCWD, with its holdings in the Kellogg Creek watershed, or EBRPD.

The mitigation plan should include assessing the habitat value of the affected population, determining the appropriate mitigation approach and ratio, selecting potential mitigation sites, developing a site-specific mitigation plan, developing success criteria, and assessing success of the mitigation plan.

Successful creation of a new population would be determined by measuring its ability to function with little or no intervention or management and its ability to replace the same number of plants as did the eliminated population. The second and third components should be based on comparisons of plant establishment and reproductive success of the mitigation site to an undisturbed reference habitat.

A degraded, nearby population should be protected through a conservation easement or other method while the creation effort is undertaken. If initial attempts to establish a new population prove unsuccessful after a 5-year period, the feasibility of continuing the mitigation plan should be assessed. If continuation is considered infeasible, then land supporting a nearby degraded population of the same species should be purchased through fee title or a conservation easement. Following adoption of protective measures, the site should be enhanced as described below in an effort to increase the size and viability of the population. Although the loss of a population would still be considered a significant impact, these measures would partially mitigate the impact by ensuring permanent protection of an unmanaged population and increasing its population size.

7-12: Compensate for Partial Loss, Fragmentation, or Degradation of Special-Status Plant Populations. To mitigate the loss of a portion of a special-status plant species population, the adjacent undisturbed portion of the population could be enhanced and protected permanently. To achieve full mitigation, the population size of the enhanced population should be increased by the approximate number of eliminated plants. If unaffected portions of the population cannot be enhanced sufficiently to achieve this objective, other nearby degraded populations should also be enhanced. Permanent protection, using transfer of fee title or a conservation easement to a nonprofit land management entity, would be required to fully mitigate the impact.

A pilot enhancement effort should be undertaken initially to assess the feasibility of enhancement. If successful, the effort should be expanded to meet the mitigation objective. If unsuccessful, purchase and enhancement through improved land management (e.g., installing enclosures or restricting or eliminating grazing) of an existing population may be required.

Incidental Construction Impacts

7-13: Prevent Temporary Disturbance of Significant Natural Communities, Jurisdictional Wetlands, and Other Waters of the United States. Many project features pass near or through significant natural communities, jurisdictional wetlands, or other waters of the United States. Where these resources are located adjacent to construction zones, they must be shielded from possible disturbance during construction with a temporary barrier that protects both the resource and an appropriate buffer zone. Construction contracts should state that such preserve areas would be afforded this security. Any unavoidable disturbances to wetland communities should be restricted to the dry period. If incidental construction impacts occur, they should be mitigated as specified above.

7-14: Prevent Temporary Disturbance of Special-Status Plant Populations. Special-status plant species populations in areas adjacent to construction corridors should be protected from possible disturbance during construction, as described above under "Prevent Temporary Disturbance of Significant Natural Communities, Jurisdictional Wetlands, and Other Waters of the United States".

Additional Mitigation Measures for Each Alternative

Los Vaqueros Reservoir Alternative

The following mitigation measures apply to impacts of the Los Vaqueros Reservoir Alternative that are not covered by mitigation measures recommended above, or relate to specific measures to partially avoid impacts that could be implemented in addition to those described above.

7-15: Compensate for Unavoidable Valley Oak Woodland Losses. The unavoidable loss of valley oak woodlands could be compensated by developing and implementing an accepted enhancement and restoration plan that has been reviewed by DFG and USFWS.

Mitigation Goal. The long-term goal of valley oak woodland mitigation should be to achieve no-net loss of oak woodland acreages and values. This goal may not be achievable in the short-term because of the enormous amount of time involved in establishing a mature valley oak woodland.

Mitigation Objectives. Mitigation objectives (i.e., the number of acres or trees required to compensate for lost valley oak woodland habitat should be established based on the acreage and values of each valley oak woodland eliminated. Mitigation objective should be established by comparing the baseline conditions of the affected habitat with those at the mitigation site. This habitat evaluation should employ a quantitative approach, that assigns numerical values to ecological factors, such as tree vigor, number of trees per acre, canopy cover, dbh, species richness, and species diversity. Refer to the section above entitled "Compensate for Unavoidable Alkali Marsh Losses" for a more detailed description of this type of approach. Because of the enormous amount of time involved in creating a mature valley oak woodland, both current habitat values and future habitat values expected over a long term (i.e., 75 years) should be described for the affected woodlands and the potential mitigation sites, based on current trends and expected future land uses.

Final mitigation objectives should attempt to compensate for the short-term loss of habitat values that result from the lag time between the impact and full replacement of habitat values at the mitigation site. Mitigation objectives are expected to meet or exceed 1.4 acres of replacement habitat for every affected acre. The increase in both acreage and tree density would be used to offset short-term loss of habitat values.

Mitigation Techniques. A combination of enhancement and restoration would be utilized to mitigate losses, and would occur at a suitable site near the affected occurrence. Enhancement and restoration sites should be on as large and contiguous tracts of land as possible, should be located near the impact site, and should be protected in perpetuity.

Restoration would be used to compensate for lost acreages, and would partially compensate for short-term habitat losses. Enhancement would compensate more rapidly for lost habitat values and would minimize the length of time the region experiences the loss.

Success Criteria. Success shall be measured by comparing the acreage and habitat values of the affected woodland with those achieved at the restoration and enhancement sites. Success would involve three components: creation of a self-sustaining valley oak woodland that would replicate a natural stand structure over time, minimum canopy covers of 80% for valley oak woodland and 15% for valley oak savannah, and replacement of a sufficient amount of valley oak woodland habitat to offset short-term and long-term habitat values and acreage losses within 75 years.

To fully mitigate significant impacts, the mitigation plan must be successfully implemented and the mitigation site protected through dedication of fee title or conservation easement to an entity that can guarantee protection in perpetuity.

Monitoring. Two types of monitoring should be performed: periodic monitoring of the mitigation site, and an assessment of the development and implementation of a mitigation plan as described below. Intensive monitoring of the mitigation sight should continue on a periodic basis during seedling establishment for a minimum of 5 years. If necessary, remedial measures, such as supplemental watering, replanting, or fencing should be implemented as specified in the monitoring report. Once seedlings are established, monitoring should continue on a less frequent basis to ensure that the mitigation site achieves the mitigation objective (no net loss of habitat acreage or value) within the specified time frame (i.e., 75 years).

A monitoring report should be required on a periodic basis that summarizes the results of plan implementation and documents oak establishment, species composition, and vegetative cover of the mitigation site. The monitoring report should also assess the success or failure of the mitigation plan and recommend implementation of remedial measures, if necessary, to meet success criteria.

Site-Specific Mitigation Plan. A site-specific mitigation plan should be developed, based on mitigation goals and objectives discussed above.

The mitigation plan should specify mitigation techniques and expected results; schedule and cost estimate; management and monitoring requirements; the species, type, and age of planting stock; the location, density, timing, and method of planting; short-term management goals to ensure seedling establishment and overall stand structure; long-term management goals to ensure success of the mitigation plan; and criteria for success and remedial measures that would be employed if success was not achieved within the prescribed time.

Availability of Mitigation Sites. A preliminary assessment indicates the presence of approximately 260 acres of suitable mitigation sites for valley oaks adjacent to the inundation area of the Los Vaqueros Reservoir and 75 acres adjacent to Marsh Creek. These sites are considered desirable because they are relatively large and near the impact area, are considered most suitable for establishing valley oaks (e.g., are known to have supported valley oaks or currently support remnants of valley oak woodlands, and have soils that are known to support valley oaks in the vicinity) and appear compatible with other CCWD projects or management goals (Jones & Stokes Associates 1991a).

7-16: Restrict Access and Limit Subdivision of Adjacent Parcels to Prevent Potential Secondary Impacts of Vasco Road Relocation. To prevent impacts on alkali wetlands in large valley bottoms adjacent to the relocated Vasco Road, Contra Costa County should restrict access to the alignment and prevent parcel subdivision. These actions would be consistent with the general plan and would reduce impacts to less-than-significant levels.

7-17: Realign Los Vaqueros Pipeline. The mixed riparian woodland along Sand Creek should be avoided by moving this alignment east approximately 50 feet, running the alignment parallel for approximately 1,000 feet, then rejoining the original alignment. The mixed riparian woodland along Marsh Creek could also be avoided by shifting the alignment 20 feet east of and parallel to the woodlands for approximately 1,000 feet, then rejoining the original alignment after crossing an orchard. East of Vasco Road, the pipeline should be shifted to avoid an extensive mosaic of alkali wetland communities by aligning the water conveyance pipeline with the Vasco Road relocation corridor.

7-18: Develop Final Recreation Plan. The final recreation plan should be developed in consultation with qualified resource managers with expertise in managing and restoring natural resources. The plan also should be developed in consultation with DFG and USFWS to demonstrate conformance with the guidelines outlined in the Stage 2 EIR/EIS Technical Report (bound separately).

7-19: Incorporate Fuel and Fire Management Guidelines into the Watershed Management Plan. A watershed management plan should be developed by qualified resource managers in consultation with the appropriate agencies, including DFG and USFWS. The following measures should be incorporated into

the plan to avoid impacts on special-status plant populations and significant natural communities that could result from fuel and fire management practices:

- Avoid siting firebreaks on special-status plant populations or significant natural communities.
- Prevent erosion downslope from firebreaks and similar devegetated areas.
- Protect retained botanical resources from fire management activities by using best management practices (e.g., fencing or flagging firebreaks before construction, reducing erosion in areas upslope from botanical resources, and preventing hydrological modification in adjacent areas).

7-20: Implement Site-Specific Recommendations for Alternate Water Conveyance Configurations

7-20a: Realign Old River No. 1 Pipeline. A section of the Old River No. 1 pipeline located 1 mile northwest of Byron Hot Springs would eliminate extensive alkali wetland communities. Impacts could be minimized by slightly shifting the alignment south onto the toeslopes of adjacent hills and then crossing the alkali wetlands perpendicularly. Similarly, impacts on an alkali wetland located approximately 500 feet east of Vasco Road should be avoided by shifting the alignment slightly south onto the adjacent toeslopes.

7-20b: Realign Old River No. 2 Pipeline. Impacts on alkali wetland communities located east of Bixler Road should be avoided by shifting the pipeline west of and parallel to Bixler Road.

7-20c: Realign Old River No. 4 Pipeline. The Rock Slough/Old River No. 4 pipeline should be shifted approximately 200 feet to the south onto an existing berm to avoid impacts on alkali marsh and alkali meadow vegetation.

7-20d: Realign Clifton Court Forebay Pipeline. To avoid a high-quality alkali wetland mosaic, the eastern portion of the pipeline alignment adjacent to Clifton Court Forebay should be shifted to the west side of the Southern Pacific Railroad tracks and onto agricultural fields. Also, alkali wetlands could be avoided by shifting a portion of this pipeline north of Armstrong Road onto adjacent toeslopes approximately 50 feet to the south. This shift would also avoid impacts on a population of brittlescale.

This alignment should be shifted at its western end to avoid alkali wetland communities west of Vasco Road, as described for the Rock Slough/Old River No. 1 pipeline.

Kellogg Reservoir Alternative

7-21: Compensate the Loss of Valley Oak Woodland Acreage and Values. Constructing the Kellogg Reservoir would result in the purchase and protection of approximately 145 acres of valley oak woodlands in the Los Vaqueros Reservoir inundation area, which would be enhanced by improved land management under CCWD ownership. Although this provides some compensation for lost values, additional mitigation would be required to fully reduce the impacts of implementing the Kellogg Reservoir Alternative to less-than-significant levels. Mitigation for valley oak woodlands would be accomplished in a similar manner as described above for the Los Vaqueros Reservoir Alternative. Enhancement would be the primary source of mitigation and would be performed on degraded valley oak woodlands in the Los Vaqueros Reservoir inundation area.

A mitigation plan would be developed, in a manner similar to that described above under "Compensate for Unavoidable Valley Oak Woodland Losses" for the Los Vaqueros Reservoir Alternative.

Compensate for Potential Secondary Impacts of Vasco Road Relocation. Mitigation measure 7-16 should be implemented as outlined under the Los Vaqueros Reservoir Alternative. Secondary impacts

could be prevented by restriction of access and parcel subdivision by Contra Costa County or through the purchase and protection in perpetuity of alkali wetland and willow-cottonwood riparian communities in four large valley bottoms adjacent to the relocation corridor.

7-22: Avoid Mixed Riparian Woodland. As described above for the Los Vaqueros Reservoir Alternative, the mature mixed riparian woodlands along the Los Vaqueros pipeline should be avoided.

7-23: Implement Site-Specific Recommendations for Water Conveyance Facility Siting. Recommendations listed above under "Rock Slough/Old River No. 5 Configuration" for the Los Vaqueros Reservoir Alternative should be implemented.

Desalination/EBMUD Emergency Supply Alternative

7-24: Avoid, Minimize, or Compensate the Loss of Brackish Marsh. The brine disposal pipeline should be redesigned to avoid brackish marsh where feasible. Additional surveys should be conducted to locate suitable corridors to accomplish this objective. Because this community is so locally prevalent, however, complete avoidance may be infeasible. If complete avoidance is impossible, loss of brackish marsh should be minimized by either placing the pipeline along berms, existing roads, or other raised features or by crossing brackish marsh in a manner that minimizes impacts (e.g., perpendicular crossings). For example, the preliminary pipeline location is adjacent to a berm; moving the pipeline to the east, onto the berm, would substantially reduce impacts on this community.

Permanent loss of brackish marsh can be further minimized by recontouring the landscape adjacent to the buried pipeline to its original configuration. Once the soil stabilizes to the natural contour, the disturbed area should be revegetated with appropriate brackish marsh vegetation, such as pickleweed, saltgrass, and fleshy jaumea.

Permanent loss of brackish marsh should be compensated for by restoring adjacent degraded occurrences in a manner similar to that described above in the "Compensate the Loss of Alkali Marsh" section.

Middle River Intake/EBMUD Emergency Supply Alternative

Additional mitigation measures are not required for the Middle River Intake/EBMUD Emergency Supply Alternative. Refer to the "Mitigation Measures Common to All Alternatives" section above.

Chapter 8. Wildlife Resources

AFFECTED ENVIRONMENT

Eastern Contra Costa County

Habitat types within the project area include grasslands, wetlands, riparian woodland, chaparral, oak woodlands, rock outcrops, and agricultural and developed land. These habitats are aggregates of local plant communities discussed in the "Affected Environment" section of Chapter 7, "Vegetation Resources", but are simplified for use in this chapter to reflect the more generalized habitat relationships of wildlife (Table 8-1). Locations and acreage of most of the habitat types are discussed in the "Affected Environment" section of Chapter 7, "Vegetation Resources". Scientific names of all wildlife species observed by Jones & Stokes Associates during fieldwork or mentioned in the text are listed in the Stage 2 EIR/EIS Technical Report (bound separately). Special-status species are discussed separately.

Kellogg Creek Watershed and Vicinity

The Kellogg Creek watershed is located between coastal and interior habitats and contains a diversity of species and habitats characteristic of several ecological regions. The area has biotic elements of local and regional significance that have been recognized and protected in adjacent natural areas, including Mt. Diablo State Park, Corral Hollow Ecological Reserve, Morgan Territory Regional Preserve, the planned Round Valley Regional Preserve, and Vasco Caves Ecological Reserve.

The habitats and animals of the watershed and surrounding area were studied intensively by Jones & Stokes Associates during 1987-1990. Much of the analysis of animal life presented here is based on, and is described in more detail in, these studies (Jones & Stokes Associates 1989b, 1991f) and a 1979-1982 survey by DFG (1983).

Wildlife Associated with Major Habitats

Grasslands. Grassland is the most common habitat type in the project area. This habitat provides most of the forage for livestock, and grazing pressure varies from moderate to heavy in the area (Jones & Stokes Associates 1991c). Grazing enhances habitat quality for some wildlife species and reduces it for others.

Many wildlife species use grasslands for foraging and nesting. Grasslands near open water and woodland habitats are used by the greatest number of wildlife species. Water and riparian and oak woodlands provide places for resting, breeding, and escape cover. Amphibians and reptiles residing in grasslands include Pacific treefrogs, western fence lizards, and gopher snakes. Birds known to breed in grasslands include horned larks, western meadowlarks, and burrowing owls. Mammals include deer mice, desert cottontails, California ground squirrels, striped skunks, and coyotes.

In spring, grasslands provide most of the forage used by black-tailed deer. Small mammals in grasslands are important prey for a variety of predatory birds and mammals, including golden eagles, prairie falcons, American kestrels, red-tailed hawks, foxes, and coyotes. Heavily and moderately grazed areas tend

Table 8-1. Corresponding Natural Communities and Wildlife Habitats Identified in the Kellogg Creek Watershed

Natural Community	Wildlife Habitat
Annual grassland Valley needlegrass Alkali grassland	Grassland
Alkali meadow Valley sink scrub Alkali marsh/alkali seep Northern claypan vernal pool Ephemeral drainage Valley rock outcrop intermittent pool Stock ponds	Wetland
Valley oak woodland Willow-cottonwood riparian woodland Central coast live oak riparian woodland Mixed riparian woodland	Riparian woodland
Blue oak woodland Live oak woodland Mixed north slope cismontane woodland	Blue and live oak woodland
Diablan sage scrub Northern mixed chaparral	Chaparral
Sandstone outcrop	Rock outcrop
Dryland farmed grassland	Dryland farmed grassland
Agricultural and developed land	Agricultural and developed land
Brackish marsh	Brackish marsh

to support moderate to high populations of ground squirrels; lightly grazed or ungrazed areas support fewer squirrels, but higher populations of voles.

Wetlands. Wetlands are important communities because of their current scarcity and importance to dependent wildlife species. Several wetland communities are present in the project area, including streams, stock ponds, alkali marshes, alkali meadows, vernal pools, and rock outcrop intermittent pools (see Chapter 7, "Vegetation Resources"). Livestock have degraded many wetland areas in the project area.

Kellogg and Brushy Creeks are small, intermittent streams that flow during winter and early spring. During low- or no-flow periods, pools comprise the only aquatic habitat for resident amphibians and reptiles.

Stock ponds are small, permanent or nearly permanent bodies of open water that have been constructed throughout the area. Lower elevation ponds are associated with adjacent grasslands and dryland farming crops. Higher elevation ponds are associated with oak woodlands and chaparral. Ponds were developed to provide drinking water for livestock, but they greatly enhance wildlife diversity in the area. Water birds, including a variety of waterfowl and shorebird species, use the ponds in winter (California Department of Fish and Game 1983). Black phoebes and swallows feed on insects flying above the water. Garter snakes, striped skunks, and raccoons prey on amphibian larvae or aquatic insects. Ponds also provide drinking water for deer, foxes, and many other wildlife species.

Alkali marsh habitats generally occur in narrow bands along pond margins, creeks, and drainages in the area. Relatively little marsh vegetation exists in the project area, and most of it is in narrow strands degraded by livestock. Marshes provide habitat for a variety of wildlife species, including shorebirds, songbirds, northern harriers, and raccoons. Dabbling ducks, such as mallards and cinnamon teal, nest in small numbers in the cattails and grasses along pond margins, but nesting habitat is limited because of grazing.

Alkali meadow habitats support many wildlife species that occur in nearby upland sites. When flooded, these meadows attract a variety of waterfowl and shorebird species. During dry periods, alkali meadows provide habitat for upland bird species, such as western meadowlarks and loggerhead shrikes, and numerous small mammals.

Vernal pools are an ephemeral aquatic habitat to which several invertebrate and amphibian species have adapted. Aquatic invertebrates, such as fairy shrimp and crawling water beetles, inhabit standing water, while amphibian species, such as western toads, various salamander species, and Pacific treefrogs, use the water for egg laying and rearing of young.

Several intermittent pools associated with rock outcrops are located in the portion of the watershed east of Vasco Road. Some pools support several California endemic fairy shrimp species (see "Special-Status Wildlife Species" below). The pools provide a temporary drinking water source for many wildlife species.

Riparian Woodlands. Riparian woodlands occur along intermittent creeks in the project area. Heavy grazing has reduced the amount and quality of riparian habitat in the project area; nevertheless, the habitat remains an important wildlife resource because of its scarcity regionally and statewide.

The riparian woodland community is used by a variety of wildlife species. This habitat produces abundant aquatic and terrestrial invertebrates that are prey for amphibians and reptiles, such as California slender salamanders, common garter snakes, western skinks, and ringneck snakes, as well as insectivorous birds, such as warblers, northern flickers, downy woodpeckers, and flycatchers. Small mammals found in riparian habitats include shrews, voles, bats, and mice. Raptors that nest in large riparian trees include great-horned owls, red-tailed hawks, and American kestrels. Cavity-nesting species, such as woodpeckers, bats, squirrels, and raccoons, require mature stands of trees. Striped skunks, raccoons, red foxes, gray

foxes, and badgers forage in riparian habitats and use them for cover and travel. Black-tailed deer use riparian areas for feeding and cover and as travel routes.

Blue and Live Oak Woodland. Oak woodlands in the project area vary from sparse stands with a grass understory to denser stands of oaks with well-developed shrub understories.

Oaks and their associated shrub species provide food, shade, shelter, and nesting habitat for many wildlife species. Several specialized wildlife species depend on oaks. Oak mast (acorns) is an important food source for acorn woodpeckers, band-tailed pigeons, western gray squirrels, and black-tailed deer (Verner and Boss 1980). Oak trees provide nesting sites for golden eagles and red-tailed hawks, as well as for cavity nesters, such as western bluebirds and American kestrels. Many amphibian and reptile species live in the cool, shady areas beneath oaks, including ensatinas, Gilbert's skinks, ringneck snakes, and racers. Shrub species such as manzanita, sage, buckbrush, and toyon, which provide cover and a food source for wildlife species, enhance the value of the oak woodlands.

Resident deer occur primarily in oak and chaparral habitats on the west side of Kellogg Creek but are also present in scattered oak woodlands east of Kellogg Creek. Deer density in the project vicinity is nearly three times higher in chaparral than in woodland habitat (California Department of Fish and Game 1983), although overall deer population density is low throughout the project area.

Chaparral. Chaparral habitat dominates steep, upper elevation slopes with shallow soils in the western portion of the watershed area. Chaparral is common in the Central Valley foothills of California. Within the project area, chaparral provides the main habitat for the Alameda whipsnake, a state-listed threatened species (see "Special-Status Wildlife Species" below). Amphibians and reptiles that use chaparral include ensatinas, western fence lizards, western skinks, racers, and common kingsnakes. Wrentits, rufous-sided towhees, and California thrashers are common birds in chaparral. Mammals include ornate shrews, California pocket mice, gray foxes, and black-tailed deer. Wildlife species diversity is higher at the habitat edges where chaparral abuts grassland, oak woodlands, and rock outcrops.

Rock Outcrops. Rock outcrops, especially undisturbed sites suitable for raptor nesting, are relatively uncommon in California and in the watershed area. The most important kind of outcrop is cliffs, which provide nesting areas for raptors and other birds. Cliffs suitable for raptor nesting are nearly vertical walls at least 20 feet tall with ledges, potholes, or other recesses to support nests. Cliffs in the area provide important nesting habitats for many raptors, including golden eagles, prairie falcons, red-tailed hawks, turkey vultures, common barn owls, and great-horned owls (Jones & Stokes Associates 1989b). Ravens also commonly nest on cliffs in the project area. Cliff swallow colonies occur on several rock faces.

Other outcrops of accumulated surface rocks are found in most habitat types in the watershed area. Clusters of rock outcrops provide cover and burrowing sites for amphibians, reptiles, and small mammals.

Agricultural and Developed Land. Agricultural land in the watershed area consists of dryland farming and has low value to most wildlife because of frequent ground and vegetation disturbance, which discourages nesting and denning. Agricultural land is used by mammalian predators, including badgers, foxes, and coyotes, but prey numbers and resulting predator use are generally lower than in uncultivated grasslands. Red-tailed hawks, golden eagles, turkey vultures, and northern harriers forage in dryland crops in the watershed area, but their use is probably also reduced by lower prey availability.

Developed land in the area includes roads, buildings, windfarm developments, and other extensively disturbed areas. Farmhouses, barns, and ornamental plantings are attractive to certain species, including house mice, common barn owls, rock doves, and barn and cliff swallows. Red-breasted sapsuckers and northern mockingbirds feed on ornamental fruit-producing trees and shrubs. Disturbance by humans, dogs, and cats at developed sites may reduce habitat values in adjacent natural areas.

Lands developed for windfarms or highways generally have reduced value for wildlife because of the reduced habitat. The value of areas surrounding wind turbines is also reduced for raptors and other birds because of flight obstruction and the possibility of collision with wind turbines (Estep 1989, Biosystems Analysis 1991).

Special-Status Wildlife Species

For this report, special-status wildlife species are defined to include animals that:

- are listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (50 CFR 17.11 for listed animals and various notices in the Federal Register for proposed species);

- are Category 1 or 2 candidates for possible future listing as threatened or endangered under the federal Endangered Species Act (54 FR 554-579, January 6, 1989);

- meet the definitions of rare or endangered species under CEQA (State CEQA Guidelines Section 15380);

- are listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (14 CCR 670.5);

- are species of special concern to the DFG (Remsen 1978 for birds and Williams 1986 for mammals);

- are species that are fully protected in California (Cal. Fish and Game Code, Section 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians]); and are species of special interest to DFG and NDDB; and

- are species of special interest to DFG and NDDB.

Special-status wildlife species that are known or have potential to occur in areas potentially affected by the alternatives and their legal status are listed in Table 8-2. Their habitat relationships, geographic distribution, occurrence in the project area, and reasons for decline are included in the Stage 2 EIR/EIS Technical Report (bound separately). Surveys for special-status species were conducted during 1987 through 1991 (Jones & Stokes Associates 1989, 1991f). Species that were observed or could occur on a regular basis are presented in Table 8-3. (More detailed information on special-status species is included in California Department of Fish and Game 1983 and Jones & Stokes Associates 1989b, 1991f.) Special-status species locations in the vicinity of the Kellogg Creek watershed and relocated Vasco Road are shown in Figures 8-1 through 8-4.

ENVIRONMENTAL CONSEQUENCES

Criteria for Conclusions of Significance

Conclusions regarding the significance of impacts on wildlife resources are based on definitions contained in the State CEQA Guidelines, NEPA regulations, and the federal and state Endangered Species Acts.

Table 8-2. Special-Status Wildlife Species with Potential to Occur in the Project Area

Species	Legal Status[a] Federal/State	Species	Legal Status[a] Federal/State
Invertebrates			
Bay checkerspot butterfly *(Euphydryus editha bayensis)*	T/--	Molestan blister beetle *(Lytta molesta)*	C2/--
California linderiella *(Linderiella occidentalis)*	1R/--	San Francisco forktail damsel-fly *(Ischnura gemina)*	C2/--
Curve-footed hygrotus diving beetle *(Hygrotus curvipes)*	C2/--	Valley elderberry longhorn beetle *(Desmocerus californicus dimorphus)*	T/--
Longhorn fairy shrimp *(Branchinecta longiantenna)*	1R/--	Vernal pool fairy shrimp *(Branchinecta lynchi)*	1R/--
Moestan blister beetle *(Lytta moesta)*	C2/--	Vernal pool tadpole shrimp *(Lepidurus packardi)*	2R/--
Amphibians			
California red-legged frog *(Rana aurora draytoni)*	C1/SSC	California tiger salamander *(Ambystoma tiginum californiense)*	C2/SSC
Reptiles			
Western pond turtle *(Clemmys marmorata)*	C1/SSC	Alameda whipsnake *(Masticophis lateralis euryxanthus)*	C2/T
California horned lizard *(Phrynosoma coronatum frontale)*	--/SSC	Giant garter snake *(Thamnophis couchi gigas)*	1R[+]/T
Birds			
Aleutian Canada goose *(Branta canadensis leucopareia)*	E/--	Northern harrier *(Circus cyaneus)*	--/SSC
California clapper rail *(Rallus longirostris obsoletus)*	E/E	Swainson's hawk *(Buteo swainsoni)*	--/T

Species	Legal Status[a] Federal/State	Species	Legal Status[a] Federal/State
Birds (continued)			
California black rail *(Laterallus jamaicensis coturniculus)*	C1/T	Ferruginous hawk *(Buteo regalis)*	C2/--
Greater sandhill crane *(Grus canadensis tabida)*	--/T	Sharp-shinned hawk *(Accipiter striatus)*	--/SSC
California least tern *(Sterna antillarum browni)*	E/E	Cooper's hawk *(Accipiter cooperii)*	--/SSC
Long-billed curlew *(Numenius americanus)*	C2/--	Burrowing owl *(Athene cunicularia)*	--/SSC
Bald eagle *(Haliaeetus leucocephalus)*	E/E	Tricolored blackbird *(Agelaius tricolor)*	C2/--
Golden eagle *(Aquila chrysaetos)*	--/SSC	Saltmarsh yellow-throat *(Geothlypis trichas sinuosa)*	C2/--
Osprey *(Pandion haliaetus)*	--/SSC	Suisun song sparrow *(Melospiza melodia maxillaris)*	C2/SSC
Black-shouldered kite *(Elanus caeruleus)*	--/CP	Great blue heron rookeries *(Ardea herodias)*	--/--*
American peregrine falcon *(Falco peregrinus anatum)*	E/E	Waterfowl	--/--*
Prairie falcon *(Falco mexicanus)*	--/SSC		
Mammals			
Saltmarsh wandering shrew *(Sorex vagrans halicoetes)*	C1/SSC	San Pablo vole *(Microtus californicus sanpabloensis)*	C2/--
Suisun ornate shrew *(Sorex ornatus sinuosus)*	C1/SSC	San Joaquin kit fox *(Vulpes macrotis mutica)*	E/T
Pacific western big-eared bat *(Plecotus townsendii townsendii)*	C2/SSC	Ringtail *(Bassariscus astutus)*	--/CP
Salt marsh harvest mouse *(Reithrodontomys raviventris)*	E/E	American badger *(Taxidea taxus)*	--/SSC

Table 8-2. Continued

Species	Legal Status[a] Federal/State	Species	Legal Status[a] Federal/State
San Joaquin pocket mouse *(Perognathus inornatus inornatus)*	C2/--	Mule deer *(Odocoileus hemionus)*	--/--*

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act (50 CFR 17.11).

T = listed as threatened under the federal Endangered Species Act (50 CFR 17.11).

C1 = Category 1 candidate for federal listing. Category 1 includes species for which USFWS has on file enough substantial information on biological vulnerability and threat to support proposals to list them (54 FR 554, January 6, 1989).

C2 = Category 2 candidate for federal listing. Category 2 includes species for which USFWS has some biological information indicating that listing may be appropriate but for which further biological research and field study are usually needed to clarify the most appropriate status. Category 2 species are not necessarily less rare, threatened, or endangered than Category 1 species or listed species; the distinction relates to the amount of data available and is therefore administrative, not biological (54 FR 554, January 6, 1989).

1R = recommended for Category 1 status (White pers. comm.).

2R = recommended for Category 2 status (White pers. comm.).

+ = proposed for listing as an endangered species (56 FR 249, December 27, 1991).

State

E = listed as endangered under the California Endangered Species Act (14 CCR 670.5).

T = listed as threatened under the California Endangered Species Act (14 CCR 670.5).

CP = fully protected under the California Fish and Game Code (Cal. Fish and Game Code, Sections 3511, 4700, 5050).

SSC = species of special concern (Remsen 1978 and Williams 1986).

* = species of special interest tracked by DFG or NDDB.

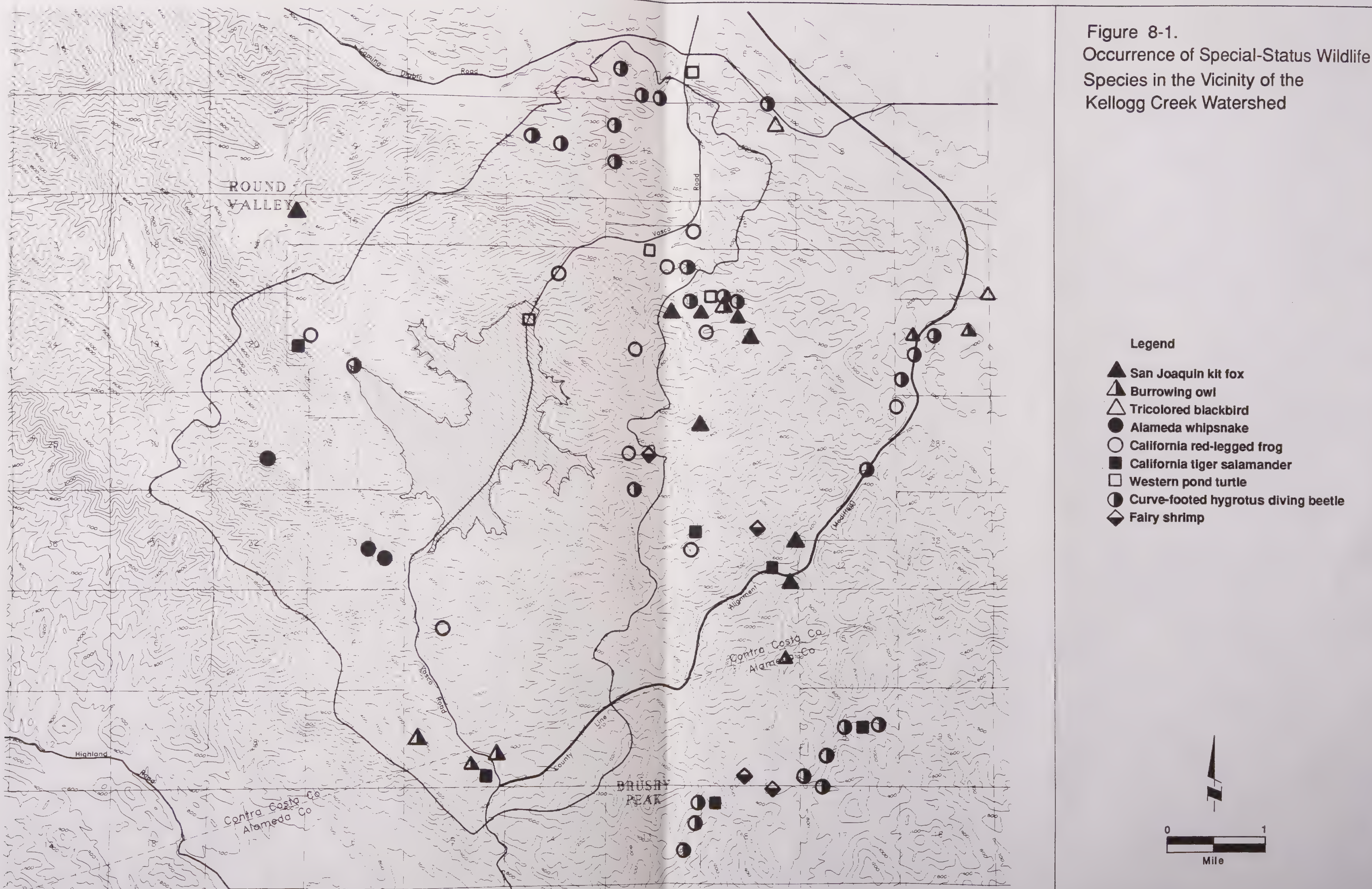


Figure 8-1.
Occurrence of Special-Status Wildlife Species in the Vicinity of the Kellogg Creek Watershed

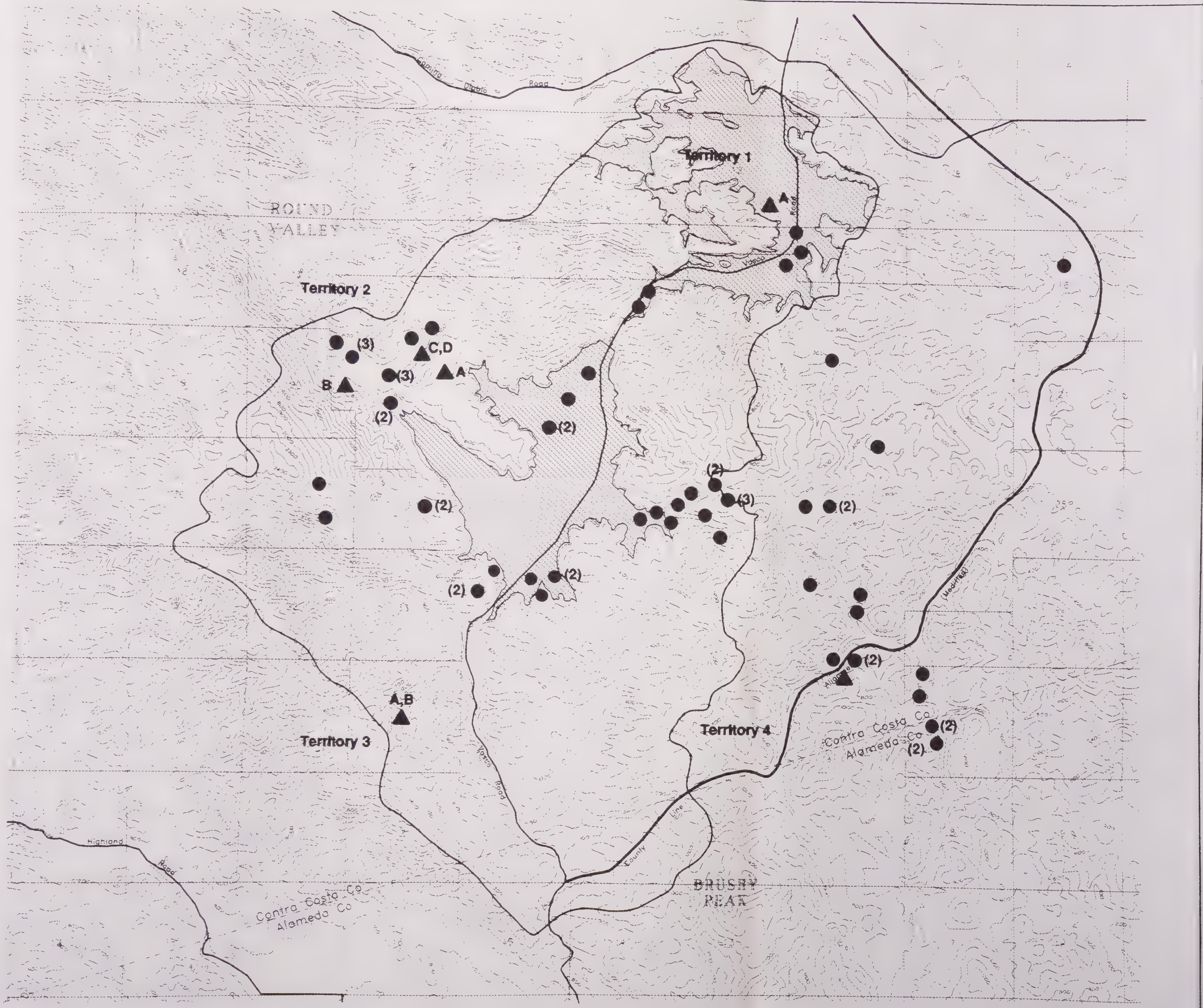


Figure 8-2.
Golden Eagle Territories, Nest, and Sightings in and Adjacent to the Kellogg Creek Watershed 1989-1990

Legend

▲ Nests (Inactive)
A (1988) (Active)
B (1989) (Active)
C (1990) (Active)
D (1991) (Active)

● Sightings
February-August 1989,
June and November 1990

(#) Number Seen Together

Figure 8-3. Occurrence of Special-Status Amphibians and Reptiles and Sample Sites in the Vicinity of the Kellogg Creek Watershed

Legend

- California Red-Legged Frog
- California Tiger Salamander
- Western Pond Turtle
- Observation Source (NDDB 1958-1971)
- Water Bodies Sampled (No Special-Status Amphibians or Reptiles Found)

0 1
Mile

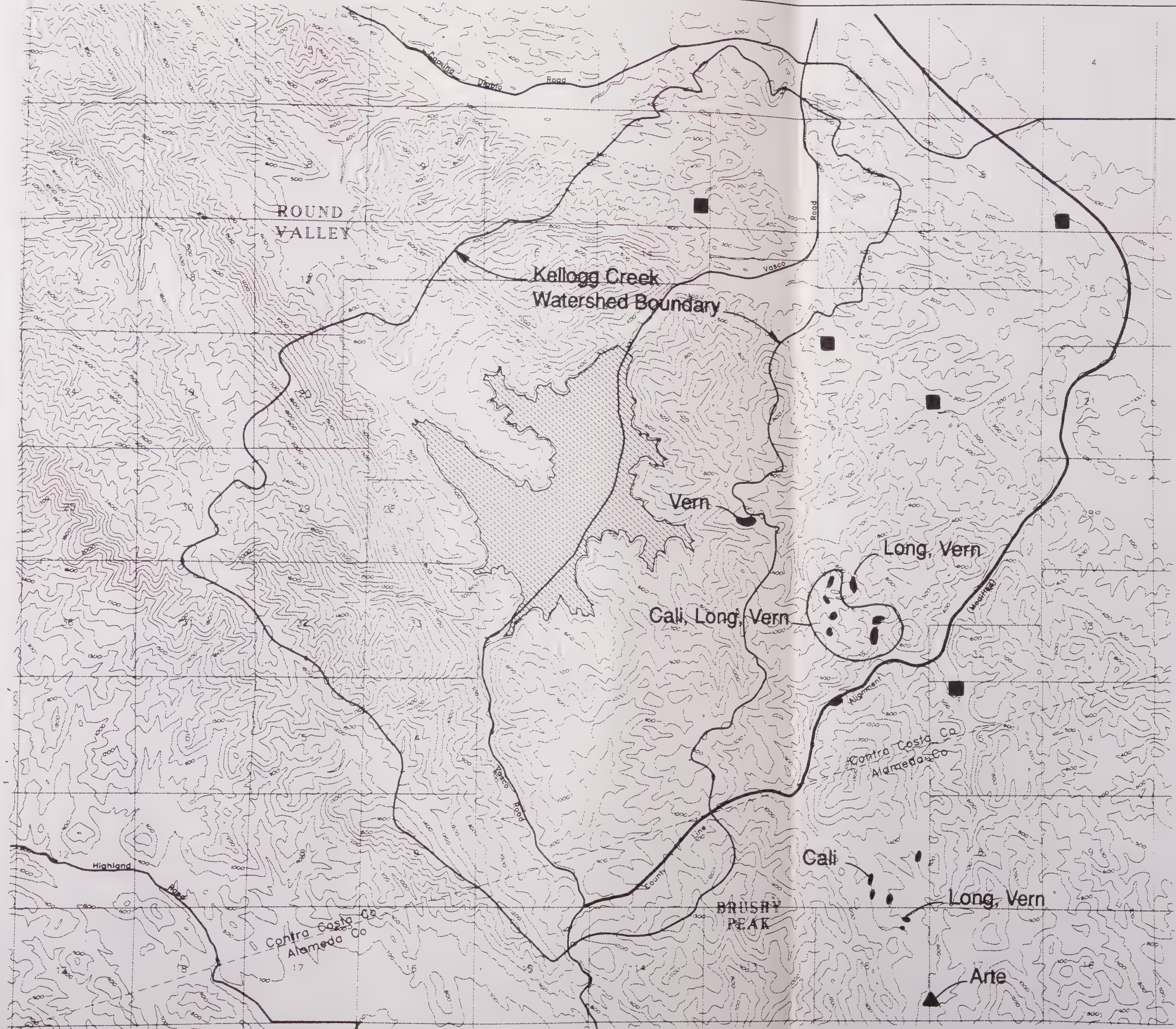


Figure 8-4.
Known Locations of and Potential Sites for Fairy Shrimp Species in the Vicinity of the Kellogg Creek Watershed

LEGEND

	Valley rock outcrop Intermittent pools
	Claypan vernal pool
	Saline water bodies
Arte	*Artemia* sp. (probably *franciscana*)
Cali	California linderiella fairy shrimp
Long	Longhorn fairy shrimp
Vern	Vernal pool fairy shrimp

Table 8-3. Special-Status Wildlife Species Observed during Surveys in the Project Area

Species	Distribution	Preferred Habitat	Occurrence in the Project Area	Reasons for Decline
Invertebrates				
California linderiella (*Linderiella occidentalis*)	East side of Central Valley from east of Red Bluff to east of Madera, across the Sacramento area and through the central and south Coast Ranges from Lake to Riverside County	Common in vernal pools; also found in sandstone rock outcrop pools	Kellogg Creek watershed: In sandstone rock outcrop pools Conveyance facilities: No known occurrences; potential habitat in vernal pools	Habitat loss to agricultural and urban development
Curve-footed hygrotus diving beetle (*Hygrotus curvipes*)	Western side of the San Joaquin Valley from Oakley in Contra Costa County south to Alameda County	Small ponds, roadside ditches, vernal wetlands, and pools in intermittent streams, most of which dry up during the summer and support salt-tolerant vegetation	Kellogg Creek watershed: In water bodies throughout the watershed Conveyance facilities: Potential habitat in suitable water bodies	May be more abundant than once thought
Longhorn fairy shrimp (*Branchinecta longiantenna*)	Eastern margin of central Coast Ranges from Contra Costa to San Luis Obispo County	Small, clear pools in sandstone rock outcrops or clear to moderately turbid clay- or grass-bottomed pools	Kellogg Creek watershed: In sandstone rock outcrop pools Conveyance facilities: No known occurrences; potential habitat in vernal pools	Habitat loss
Vernal pool fairy shrimp (*Branchinecta lynchi*)	Central Valley, central and south Coast Ranges from Tehama to Santa Barbara County; isolated populations also in Riverside County	Common in vernal pools; also found in sandstone rock outcrop pools	Kellogg Creek watershed: In sandstone rock outcrop pools Conveyance facilities: No known occurrences; potential habitat in vernal pools	Habitat loss to agriculture and urban development
Amphibians				
California red-legged frog (*Rana aurora draytonii*)	British Columbia south to northern Baja California	Permanent aquatic habitats, such as creeks and ponds, with emergent and submergent vegetation; may estivate in burrows during dry periods	Kellogg Creek watershed: In Kellogg and Brushy Creeks, and several stock ponds Conveyance facilities: Potential habitat in creeks and stock ponds	Habitat destruction and competition and predation by fish and bullfrogs
California tiger salamander (*Ambystoma tiginum californiense*)	Butte County in north to Santa Barbara County in south	Open woodlands and grasslands; requires aquatic areas such as ponds or streams for breeding; burrows up to 1 mile from breeding site during summer dormancy	Kellogg Creek watershed: In stock ponds and Kellogg Creek Conveyance facilities: Potential habitat in stock ponds and adjacent upland annual grassland habitat	Loss of grassland habitat to agricultural and urban uses

Species	Distribution	Preferred Habitat	Occurrence in the Project Area	Reasons for Decline
Reptiles				
Western pond turtle (*Clemmys marmorata*)	Western Washington south to Baja California	Still waters such as ponds, reservoirs, and sluggish streams	Kellogg Creek watershed: In permanent pools in Kellogg Creek and stock pond about 1 mile east of the proposed dam sight Conveyance facilities: Potential habitat in slow-moving sloughs and creeks; one observed in Marsh Creek Reservoir	Loss of aquatic habitat to agricultural development, water diversion, stream channelization, and urbanization; loss of breeding habitat adjacent to aquatic habitat
Alameda whipsnake (*Masticophis lateralis euryxanthus*)	Alameda and Contra Costa Counties	Valleys, foothills, and low mountains in ecotonal areas of dry coastal scrub with grassland, oak woodland, or riparian vegetation	Kellogg Creek watershed: In suitable habitat Conveyance facilities: No suitable habitat	Habitat loss caused by urban expansion
Birds				
California black rail (*Laterallus jamaicensis coturniculus*)	Point Reyes, San Francisco Bay, Sacramento/San Joaquin River Delta, and southern California	Pickleweeds and tule marshes with adjacent uplands	Kellogg Creek watershed: No suitable habitat Conveyance facilities: Nearest record at Bacon Island bridge on Middle River, approximately 1 mile north of proposed Middle River intake; potential breeding habitat at Suisun Bay near West Pittsburg	Loss of tidal and inland wetlands by filling and draining
Golden eagle (*Aquila chrysaetos*)	Resident throughout California	Nests in cliffs or trees, preferably overlooking grasslands where prey is available	Kellogg Creek watershed: Several nesting pairs Conveyance facilities: Potential foraging habitat where prey species present	Habitat loss, human persecution, and declines in prey species abundance
Prairie falcon (*Falco mexicanus*)	Throughout California in suitable habitat	Nests on cliff ledges; feeds on insects, small mammals, and birds	Kellogg Creek watershed: Observed foraging and nesting Conveyance facilities: Potential foraging habitat	Pesticide contamination, human persecution, decline in prey species abundance
Burrowing owl (*Athene cunicularia*)	Open habitats throughout California	Open, dry, and nearly level grassland or prairie habitat	Kellogg Creek watershed: Uncommon permanent resident Conveyance facilities: Uncommon permanent resident in suitable habitat	Habitat loss

Table 8-3. Continued

Species	Distribution	Preferred Habitat	Occurrence in the Project Area	Reasons for Decline
Tricolored blackbird (*Agelaius tricolor*)	Lowlands and valleys throughout California	Breeds in freshwater marshes and blackberry thickets; forages in wetlands, grasslands, agricultural fields, and irrigated pastures; known to forage up to 5 miles from nesting colony during breeding season	Kellogg Creek watershed: No suitable breeding habitat Conveyance facilities: Nearest known colonies at Marsh Creek Reservoir and Unimin plant	Loss of wetland breeding habitat, nest disturbance, aerial spraying of herbicides and pesticides, and mortality from poisoned grain (Terres 1987, U.S. Fish and Wildlife Service 1985)
Mammals				
San Joaquin kit fox (*Vulpes macrotis mutica*)	Portions of western Kern, eastern San Luis Obispo, western Tulare, Kings, western Fresno, western Merced, western Stanislaus, southwestern San Joaquin, Alameda, Contra Costa, Santa Clara, San Benito, Monterey, and extreme northern Santa Barbara Counties	Grasslands, saltbush, open woodlands, and alkaline sink valley floor	Kellogg Creek watershed: Kit foxes observed in several locations; one known breeding pair Conveyance facilities: Potential habitat in annual grasslands on the western side of San Joaquin Valley	Habitat loss is the major factor; also road kills, shooting, poisoning, and predation by coyotes

Under CEQA, a project would have a significant effect on the environment if it substantially diminished wildlife habitat, substantially affected a threatened or endangered animal or habitat of the species, or interfered with the movement of any resident or migratory wildlife species. CEQA (Section 15380) specifically provides protection to species, regardless of whether they are formally listed as threatened or endangered, based on their rarity or degree of endangerment.

Under NEPA, the Council of Environmental Quality regulations state that the lead agency impact evaluation must identify "the degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act".

Criteria for determining impact significance are assessed separately for common wildlife species and special-status species.

Common Wildlife Species

Impacts on common wildlife species are assessed by examining the habitat type and acreages eliminated and comparing these losses to local and regional habitat abundance. Generally, elimination of small acreages of wildlife habitat is considered a less-than-significant impact, depending on site-specific circumstances and regional context. Impacts on common wildlife species that use grasslands are not considered significant because the species and habitat are abundant regionally and statewide. Loss of 1 acre or less of riparian woodlands and less than 20 acres of oak woodlands is considered a less-than-significant impact because of the widespread occurrence of these habitats in the coastal mountain ranges. Loss of wetlands is generally considered a less-than-significant impact within the project area because of the small areas eliminated. Loss or degradation of several miles of a major drainage, such as Brushy or Kellogg Creeks, is considered a significant impact because of the relatively large amount of habitat lost and the abundance of wildlife species that use this habitat type.

Special-Status Wildlife Species

In addition to the protection of special-status species under the State CEQA Guidelines and NEPA regulations, the federal Endangered Species Act requires that any action carried out by a federal agency must not jeopardize the continued existence of any endangered or threatened species or modify these species' critical habitats. The state Endangered Species Act is similar and requires state agencies to ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify "essential habitat", which is defined as habitat necessary to the continued existence of the species. Therefore, any action that results in the following types of impacts is significant under the federal Endangered Species Act:

- actions that jeopardize the continued existence of listed species or adversely modify the species' critical habitat; jeopardy exists when an action would "appreciably reduce the likelihood of the survival and recovery of a listed species;

- taking of any species of fish or wildlife listed as threatened or endangered (take is broadly defined to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct; the term "harm" includes destruction of habitat that prevents an endangered species from recovering);

- loss of occupied or suitable habitat that could prevent recovery of the species; or

- actions that substantially affect candidate species; although candidate species do not receive any protection under the federal Endangered Species Act, USFWS encourages federal agencies and other appropriate parties to give consideration to such taxa in environmental planning and therefore the species may qualify for protection under CEQA (14 CCR 15380).

Actions that result in the following types of impacts would be significant under the California Endangered Species Act:

- taking of any wildlife species listed as threatened or endangered (take includes hunting, pursuing, catching, capturing, or killing or attempting such activity; in practice DFG has interpreted the take prohibition in the California Endangered Species Act to include "destruction of nesting and foraging habitat necessary to maintaining the species reproductive effort") or

- actions that substantially affect species of special concern; although species of special concern do not receive any protection under the California Endangered Species Act, they are tracked by the NDDB because DFG believes the species meets the criteria for listing and therefore qualifies for protection under CEQA (14 CCR 15380).

As discussed in Chapter 3, "Delta System Hydrodynamics", the project alternatives would have only minor effects on upstream CVP reservoir levels and riverflows. These minor effects are considered to have no potential for creating impacts on wildlife and are therefore not discussed in this chapter.

Impact Mechanisms

Direct Habitat Loss Resulting from Facility Construction

As described in Chapter 7, "Vegetation Resources", the term "facility construction" in this analysis includes the following project components:

- dams, reservoir inundation area, quarry, spillway, and inlet/outlet works;

- recreational facilities (e.g., picnic areas, camping facilities, trails, access roads, staff housing, maintenance facilities, and concession stands);

- water conveyance facilities (i.e., intake pumping plant, transfer reservoir, pipelines, the Neroly blending facility, and associated electrical transmission lines);

- Vasco Road and utility relocation alignments (i.e., Vasco Road relocation alignment and natural gas pipeline, petroleum pipeline, and electrical transmission line alignments in or near the Kellogg Creek watershed);

- Desalination/EBMUD Emergency Supply Alternative facilities (i.e., desalination plant, brine disposal pipeline, EBMUD intertie pipeline, and associated electric transmission lines); and

- Middle River Intake/EBMUD Emergency Supply Alternative facilities (i.e., Middle River intake facility and pumping plant, Middle River pipeline, EBMUD intertie pipeline, Neroly blending facility, and associated electrical transmission lines).

Facility construction would both temporarily affect and permanently eliminate some wildlife habitat and species. Habitat loss is defined as the reduction in acreage or value of an area that sustains natural plant and animal populations. In addition to construction impacts from the dam, reservoir, spillway, and related facilities, wildlife species could be adversely affected during foundation preparation, grouting of the embankment foundation area, dewatering of the embankment foundation area, temporary Kellogg Creek diversion, placement of embankment materials, inlet/outlet works, reservoir clearing, quarry activities, and spoil material disposal.

Habitat Fragmentation. Habitat fragmentation is the permanent division of a natural community or plant or animal population, or the separation of a population from components essential to its natural functioning. Wildlife habitat fragmentation can disrupt the daily or seasonal movements of resident wildlife, reduce the dispersal capabilities of special-status species, and reduce habitat sizes. Consequences of habitat fragmentation include local extinctions, population reductions, prevention of colonization of suitable habitats because of increased dispersal distances, and loss of genetic diversity. Habitat changes that could lead to fragmentation include the presence of the dam, reservoir, recreational facilities, conveyance facilities, and new roads. Underground facilities such as pipelines would not typically cause habitat fragmentation.

Temporary Habitat Loss. Underground facilities such as pipelines, staging and storage areas, and access roads could temporarily eliminate wildlife habitat. Common and special-status wildlife species could be affected by temporary habitat loss through modification of patterns of habitat use or by causing disruption of breeding. Areas temporarily disturbed will be revegetated and restored to preproject conditions. Temporary disturbance areas and measures recommended to avoid, minimize, and restore affected areas before, during, and after construction will be identified.

Disturbance to Wildlife Adjacent to Habitats during Facility Construction. Biological resources located adjacent to construction sites could be disturbed by construction activities. Common and special-status wildlife species could be affected by noise from blasting and ground vibrations, dust deposition, and human activity, and mortality from construction activities that inadvertently occur outside the design footprint could also occur. The location and extent of these impacts is difficult to predict. Wildlife in adjacent areas that may be sensitive to disturbance will be identified after the alternative to be implemented is selected and measures will be recommended to avoid or minimize the disturbance during construction.

Reservoir Operation, Land Management, and Use

Reservoir operation and management could both benefit and adversely affect wildlife resources. Reservoir operation and land management practices likely to beneficially or adversely affect wildlife resources include fluctuating reservoir levels and downstream releases in Kellogg Creek, grazing, rodenticide use, farming, fire management, wind energy development, and recreational use in the Kellogg Creek watershed.

Reservoir Operation. Reservoir operations could affect wildlife resources because of fluctuating water levels in the inundation zone and in Kellogg Creek downstream of the reservoir. Fluctuating water levels in the reservoir could eliminate, degrade, or modify existing wildlife habitat. Significant adverse impacts could occur in Kellogg Creek if discharges dropped below levels required to maintain populations of water-dependent wildlife. Critical factors to evaluate include amount of water released during late winter and early spring; flow changes during the dry season; loss of permanent pools because of a drop in the water table; the possibility of increased bank erosion from high flows or sustained high-flow levels with increases in sedimentation; and rapid, wide fluctuations in discharge. Significant benefits to aquatic species, especially special-status amphibians and western pond turtles downstream of the reservoir, could occur with flow releases during critical times of the year when rainfall is low.

Grazing. Eliminating grazing in the Kellogg Creek watershed would increase grass height and could potentially reduce ground squirrel populations and subsequently reduce the habitat suitability for kit fox and other predators. A decrease in ground squirrels could also reduce the number of suitable denning sites for San Joaquin kit foxes and other burrowing animals, such as California tiger salamanders and burrowing owls.

Although eliminating grazing could substantially reduce ground squirrel populations in the watershed, such an action could encourage other prey species that prefer taller grasses.

Sensitive habitats, including ponds, marshes, vernal pools, and riparian areas, would naturally recover to some extent if grazing were eliminated. In addition, as grasslands and vegetation recover, erosion and sedimentation effects would be reduced.

Managing most areas to maintain moderate grass levels and maintaining some areas with taller grasses may be the best approach to maintaining a diverse and abundant prey base for special-status predators and other species. In addition, riparian areas and other sensitive habitats could be enhanced by protection from grazing.

Rodenticide Use. Besides the reduction or elimination of California ground squirrels (the target species), use of rodenticides can have indirect and direct impacts on other wildlife species. The elimination of prey can affect populations of predators. Rodenticides can also directly kill nontarget wildlife, such as San Joaquin kit foxes or raptors, if the animals either directly ingest the rodenticide or consume poisoned prey.

Fire Management. Fire management can either benefit or adversely affect different wildlife species through habitat modification. Prescribed burning can, in some instances, enhance biological resource values by providing a diversity of stand age classes in habitats such as chaparral. Fire protection activities, such as grading, vegetation and tree removal, and prescribed burning, could result in loss of habitat or direct mortality of special-status wildlife species. Firebreaks constructed in sensitive wildlife species habitat could cause direct mortality to ground-dwelling species such as the Alameda whipsnake, a special-status species.

Wind Energy Development. Wind energy development is not a part of the Los Vaqueros Reservoir or Kellogg Reservoir Alternatives; however, CCWD may purchase lands in the watershed with active wind energy leases. Therefore, CCWD lands may be subject to wind energy development. Impacts on wildlife could occur from clearing and leveling of turbine sites and construction of access roads and would be similar to those described for facilities construction. Wind turbines also could cause raptor mortality.

Recreation Use. Recreational use of the Kellogg Creek watershed could affect wildlife by increased human disturbances. Potential human impacts on wildlife include incidental disturbance during recreational activities, mortality caused by collisions with vehicles, and direct harassment. Chapter 2, "Alternatives Including the Proposed Action", summarizes recreation development guidelines for the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives. The guidelines recommend that recreational facilities be located at appropriate distances from biological resources to avoid significant impacts.

No-Action Alternative

Undeveloped Lands. Existing land uses in undeveloped portions of the project area include activities such as dryland farming, grazing, irrigated farming, and wind energy generation. These activities would result in impacts on wildlife species through habitat degradation especially to wetland, riparian, and valley oak woodland habitats. Wind generation activities currently cause significant impacts on raptors because of collisions and electrocution (BioSystems Analysis 1991). Kit foxes and raptors are susceptible to direct poisoning and prey reduction as a result of rodenticide use on private lands.

Land Conversion. Land uses in the Kellogg Creek watershed are dominated by livestock grazing on rangelands and wind energy generation. The portion of the project area outside the watershed consists mainly of croplands, irrigated pasture, and developed areas. Contra Costa County policies discourage urban development and encourage agricultural uses in specific areas ensuring that lands inside and outside the Kellogg Creek watershed zoned for agricultural uses remain primarily in agricultural use (Contra Costa County Community Development Department 1991).

Residential development is expected to continue under No-Action Alternative conditions on other lands in the same way as it would under project alternative conditions, resulting in impacts on wildlife resources. Development proposals similar to the approved 1,128-acre Bankhead Ranch development in the Kellogg Creek watershed that caused CCWD to initiate active planning and land acquisition for the Los Vaqueros Project would be expected.

Los Vaqueros Reservoir Alternative

Impacts discussed under this alternative are divided into the seven alternate project configurations described in Chapter 2, "Alternatives Including the Proposed Action". This section describes the impacts of the dam, reservoir, and spillway, and impacts expected from recreational facilities and water conveyance features. This section also summarizes the Vasco Road and utility relocation impacts that were addressed in detail in the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990).

Impacts Common to All Alternate Configurations

Dam, Reservoir, and Related Facility Construction in the Watershed

Common Wildlife Species. Construction of the dam and the Los Vaqueros Reservoir, spillway, inlet/outlet works, and quarry site would eliminate 542 acres of annual grasslands; 180 acres of valley oak woodlands and savanna; 21 acres of blue and live oak woodlands; 11 acres of wetlands, including one stock pond and 2.8 acres of Kellogg Creek along 7.7 miles of Kellogg Creek and its tributaries; 7 acres of agricultural and developed land; and 737 acres of dryland farmed grasslands.

Although the reservoir would result in loss of habitat for many terrestrial and aquatic species, the reservoir could provide habitat for other species, such as wintering bald eagles, migratory waterfowl, gulls, shorebirds, herons, and other waterbirds.

The Los Vaqueros dam site is at a narrow part of the Kellogg Creek valley where bedrock ridges protrude from hills on either side, which results in groundwater emerging as year-round flow in Kellogg Creek. This small flow is sufficient to maintain pools in the creekbed downstream, even in summer. These pools provide critical and scarce habitat for wildlife in the area, especially amphibians and turtles. Construction of the dam may cut off most of the groundwater seepage (see Chapter 6, "Kellogg Creek Water Resources and Public Safety").

A portion of Kellogg Creek (about 2,000-8,000 feet in length) will be dewatered and a pipeline constructed to route the flow around the dam site construction area that will span the 2-year construction period. Dewatering would eliminate aquatic habitat in portions of Kellogg Creek in the inundation zone and possibly downstream depending on the amount and timing of water releases into the creek channel. Depending on where the pipeline enters the creek downstream, and how much and when water is released, the installation of a pipeline could eliminate some downstream pool habitat. Construction materials left in streams and chemical spills during construction could degrade water quality and have an impact on aquatic species downstream.

Special-Status Species. The dam, reservoir, and facility construction sites support several special-status wildlife species, including the curve-footed hygrotus diving beetle, California red-legged frog, California tiger salamander, and western pond turtle. The area also provides habitat for foraging golden eagles and prairie falcons, and potential foraging and denning habitat for San Joaquin kit foxes.

Construction of the reservoir would permanently eliminate 722 acres of occupied kit fox habitat (270 acres would be 2 miles from a kit fox sighting and 452 acres would be 2 miles from a fox scat). USFWS

has stated that compensation should be conducted separately for two habitat categories, both of which it considers occupied habitat. These categories distinguish differences in evidence of kit fox use. The first category includes suitable habitat within 2 miles of a kit fox sighting. The second category includes suitable habitat within 2 miles of an unidentified fox scat (Simons pers. comm.). In this report, impacts on occupied habitat are identified using both criteria. In addition, 737 acres of dryland farmed grasslands would be eliminated. Dryland farmed grassland is considered low-quality kit fox habitat. Construction and inundation would eliminate at least 19 potential dens and one possibly active den and could result in kit fox mortality and disturbance during the breeding season if kit foxes move into the area before construction. Harassment by humans or dogs, illegal shooting, or vehicle-related mortalities could increase as a result of activities by construction personnel. Noise and ground vibrations caused by blasting and other construction activities could displace kit fox from nearby dens. Displacement could be detrimental, particularly if natal dens are abandoned.

Raptors, including nesting golden eagles, prairie falcons, burrowing owls, and wintering ferruginous hawks, would lose approximately 1,279 acres of foraging habitat (542 acres of annual grasslands and 737 acres of dryland farmed grasslands).

Golden eagles were regularly observed forgaging in the inundation zone. One pair nests near the inundation zone and would lose an estimated 22% of its foraging habitat. The percent loss is based on the assumption that golden eagles have a 9-square-mile home range (Jones & Stokes Associates 1989b); however, suitable foraging and nesting habitat is not limiting in the project area or immediate project vicinity. In addition, the potential habitat enhancement from district management policies to control rodenticide use in upland areas would reduce the potential for territory abandonment.

Construction during the breeding season could cause breeding failure. Reservoir construction could interfere with one known golden eagle nest. Direct impacts on nesting prairie falcons are not expected because the nearest nest site is about 3 miles away and only a small proportion of their home territory would be affected. Impacts on burrowing owls are not expected unless they move into the inundation zone before construction. If owls are present, they could be killed or disturbed by construction activities during the breeding season. Impacts on wintering ferruginous hawks are not expected because they occur irregularly and are not expected to be affected by the loss of 11% of the overall foraging habitat in the watershed.

Although tricolored blackbirds forage in the watershed during the breeding and wintering seasons, impacts are not expected because the nearest nesting colony is 4 miles away and only a small proportion of foraging habitat will be lost. Impacts on Alameda whipsnakes are not expected because they do not occur in the inundation zone or in construction or quarry areas.

Grading and inundation of water bodies and upland habitat near occupied water bodies (Kellogg Creek and stock ponds) would cause direct mortality and loss of breeding habitat for California tiger salamanders, California red-legged frogs, and western pond turtles. California tiger salamanders use ponds and pools primarily for breeding and spend most of their adult lives in upland areas up to 1 mile from a water body. Western pond turtles use ponds and pools for most of their lives but nest in upland habitat up to 0.25 mile from permanent water bodies. California red-legged frogs range throughout riparian zones and use pools and ponds for breeding.

The Los Vaqueros Reservoir would inundate approximately 2.8 acres of suitable breeding habitat for California red-legged frogs in approximately 7.7 miles of Kellogg Creek and its tributaries. In addition, the reservoir would eliminate about 50 acres of upland habitat in the riparian zone for red-legged frogs. The reservoir would eliminate about 40 acres of western pond turtle breeding habitat and about 0.2 acre of permanent pool habitat along a 0.5-mile length of Kellogg Creek. In addition, construction activities could disturb western pond turtles and California red-legged frogs in downstream Kellogg Creek. The reservoir would eliminate one stock pond. The reservoir pool would come within 0.5 mile of a stock pond that supports tiger salamanders and red-legged frogs and within 0.5 mile of another stock pond that supports red-legged frogs.

California tiger salamanders could be killed by construction traffic during their breeding migration from grasslands to water bodies if their migration route crosses a road.

Inundation would eliminate one creek site occupied by curve-footed hygrotus diving beetles.

Facility Construction: Recreational Facilities. CCWD has adopted a conceptual recreation plan that incorporates specific recreation development guidelines to maintain and enhance special-status wildlife species and important wildlife habitat in the watershed. Some of the general locations of recreation facilities presented in the conceptual recreation plan are near areas occupied by special-status wildlife species (fairy shrimp, California tiger salamanders, California red-legged frogs, and nesting golden eagles). However, most of these recreational facilities will be sited in areas designated as limited use and open use.

The development guidelines summarized in Chapter 2 present measures to avoid or minimize impacts on special-status wildlife species when the species occur near potential impact areas. As a result of siting restrictions and application of protection measures, it is possible to avoid impacts on wildlife resources from recreation facility construction.

Los Vaqueros Pipeline. Construction of the 12-mile-long Los Vaqueros pipeline could eliminate approximately 114 acres of grasslands, 102 acres of agricultural lands, 5 acres of dryland farmed grasslands, and 2 acres of wetlands.

No special-status wildlife species were observed during corridor route surveys on the 8.5-mile-long northern portion of the alignment. Grasslands provide potential foraging and denning habitat for the San Joaquin kit fox, burrowing owl, and California tiger salamander on the northern portion of the alignment. The wetlands, especially creeks, are suitable habitat for California red-legged frogs, western pond turtles, and curve-footed hygrotus diving beetles. The 3.5-mile-long southern portion of the alignment is in the Kellogg Creek watershed and follows Vasco Road and Kellogg Creek to the dam site. The pipeline would temporarily disturb 64 acres of occupied kit fox habitat. Construction could cause direct mortality and eliminate upland habitat for California red-legged frogs and western pond turtles. Because of their linear nature, pipeline corridors would generally remove only a small proportion of suitable habitat in the vicinity and substantial room would be available to move the pipeline within the corridor to avoid significant impacts.

Reservoir Operation, Land Management, and Use. The following section discusses effects on wildlife resources from reservoir operation, land management, and land use.

Purchase and Protection of Watershed Lands. CCWD's purchase of watershed lands would result in the protection of approximately 17,000 acres of habitat for common and special-status wildlife species. This purchase would prevent future development, such as the 1,128-acre Bankhead Ranch residential development project, which had been approved by the Contra Costa County Board of Supervisors. Under CCWD management, the watershed would continue to support at least 11,050 acres of annual grasslands considered occupied kit fox habitat based on a 2-mile distance from a fox scat; at least three pairs of nesting golden eagles; one to two pairs of nesting prairie falcons; and substantial populations of other wintering and breeding raptors, burrowing owls, populations of curve-footed hygrotus diving beetles, fairy shrimps, California tiger salamanders, California red-legged frogs, and western pond turtles.

Purchase and protection of watershed lands is a substantial beneficial impact of this alternative. In addition, CCWD's purchase and protection of a large area contributes to the maintenance of regional habitat and corridors for wildlife movement to other protected lands (e.g., EBRPD's Round Valley Preserve, Morgan Territory Regional Preserve, Vasco Caves, and undeveloped private lands).

Reservoir Operation. Reservoir operations could affect wildlife resources as a result of fluctuating water levels in the reservoir and in Kellogg Creek downstream of the reservoir. Periodic fluctuation in reservoir inundation levels is expected during the summer and fall months. During winter, the reservoir would provide foraging and loafing habitat for wintering waterfowl. If marsh vegetation establishes,

the reservoir could provide nesting habitat for waterfowl and tricolored blackbirds. Nesting birds could be affected if reservoir levels are drawn down and predators gain access to nests or young birds.

Grazing Management. Many annual grasslands on private lands in the watershed are grazed by private landowners at levels that exceed recommended standards (Jones & Stokes Associates 1991c). CCWD would continue to allow livestock to graze in most grasslands, but would reduce grazing intensity from high to moderate levels in substantial portions of the watershed to reduce potential water quality problems, maintain forage production, and protect habitat values. Maintaining moderate residual grass levels at the end of the fall grazing season is the best approach to maintaining a diverse and abundant prey base for special-status predators (e.g., kit foxes, golden eagles, prairie falcons, and American badgers).

Riparian areas and other sensitive habitats will be enhanced throughout the watershed by the general reduction in grazing intensity. In addition, some areas will be excluded from grazing. For example, stock ponds or important creek areas may be fenced to protect them from livestock. Part of this effort will be to mitigate impacts on Kellogg Creek (see "Mitigation Measures" section below), but other areas will be fenced to enhance watershed stability and increase general habitat values. Benefits to amphibians and reptiles, especially species that inhabitat riparian zones for most of their lives, would occur by eliminating cattle grazing within riparian zones. Open water areas at stock ponds and in creeks would likely decrease as emergent aquatic vegetation recovered. This would benefit waterfowl and possibly other marsh-nesting birds such as the tricolored blackbird.

Rodenticide Use and Predator Control. CCWD has adopted the policy that: "No predator or rodent control actions, such as poison grain baiting or trapping, shall be permitted without written approval from the District. If such control actions are required they shall be coordinated with DFG, USFWS, and EPA" (Jones & Stokes Associates 1987b).

Although recent surveys have shown that the squirrel population in the watershed has recovered and is now abundant (Jones & Stokes Associates 1991c), extensive past rodenticide use is still evident on some watershed lands. Ground squirrels were nearly eliminated in Contra Costa County in the 1970s (Orloff et al. 1986). This use may have been partially responsible for elimination of kit foxes from the area during that period. The discovery of breeding kit foxes in the watershed and the substantial recovery of ground squirrel populations also suggests a close relationship (Jones & Stokes Associates 1991c). Recently, private landowners used rodenticide in the immediate area of the kit fox natal den near the watershed. This history strongly indicates that CCWD's reduced and carefully coordinated use of rodenticides will substantially improve habitat values for the San Joaquin kit fox and other predators.

Fire Management. CCWD is implementing a fuels and fire management program to protect watershed resources and adjacent properties. The management program consists of firebreak construction along existing roads and ridgetops, spring grazing to reduce fuels in annual grasslands in high-risk areas, and periodic prescribed burning to enhance habitat values and reduce fuels buildup in chaparral stands. CCWD will coordinate fire protection activities to ensure that important biological resources are protected during firefighting operations.

Different fire management practices can benefit or adversely affect various wildlife species. Prescribed burning can enhance biological resource values by providing a diversity of stand age classes in various habitats, especially chaparral. Fire protection activities, such as fuelbreak construction, could result in direct mortality of special-status wildlife species, such as the Alameda whipsnake, or loss of habitat.

Wind Energy Development. CCWD will not acquire the wind energy development rights that have already been purchased by other individuals on lands CCWD has purchased. Therefore, CCWD will have no control over wind energy development activities on its lands with preexisting leases. CCWD will purchase full title to some land with wind energy potential.

Impacts on wildlife could occur from clearing and leveling turbine sites and constructing access roads and would be similar to those described for facilities construction. Although CCWD cannot prevent wind energy development on its lands on which it is does not own the wind energy rights, CCWD does have limited authority and could influence the locations of road or turbine pad sites to prevent erosion or other resource impacts.

Although wind turbines cause a high number of raptor mortalities every year (BioSystems Analysis 1991), wind energy development can be beneficial for some wildlife species because it provides long-term protection to associated surroundings and undisturbed lands from more damaging land uses.

Recreational Use. Recreational use of the Kellogg Creek watershed could affect wildlife resources through increased human disturbance. Potential human impacts on wildlife include incidental disturbance during recreational activities, introduction of non-native aquatic species, mortality caused by collisions with vehicles, and direct harassment.

As mentioned above under "Recreation Facility Construction", some of the locations of recreation facilities are near areas occupied by special-status wildlife species. Impacts on fairy shrimp could occur if the proposed boat-in camp were built. The camp would be located immediately below rock outcrops supporting fairy shrimp and nesting raptors. Impacts could occur on western pond turtles through the loss of nesting habitat adjacent to Kellogg Creek downstream of the reservoir. This area is designated as the Kellogg Creek recreation and staging area and would eliminate nesting habitat for pond turtles and expose them to increased human disturbance. Several recreation facilities on the western side of the reservoir could affect California tiger salamander upland and breeding habitat and an active golden eagle nest.

Summary of Impacts: Vasco Road and Utility Relocation. The following discussion summarizes the impacts of the relocation of Vasco Road, natural gas pipelines, petroleum pipelines, and electrical utilities and includes results from additional studies conducted since the Vasco Road and Utility Relocation Project EIR was certified (Jones & Stokes Associates 1990). Acreages of affected habitats are shown in Table 8-4. Because the road alignment was changed after the Vasco Road and Utility Relocation Project EIR was published (Jones & Stokes Associates 1990), additional special-status wildlife surveys were conducted for San Joaquin kit foxes, nesting golden eagles, burrowing owls, and special-status amphibians.

Common Wildlife Species. The relocation of Vasco Road would eliminate wildlife habitat in 155 acres of grasslands with a few scattered sandstone outcrops, 37 acres of dryland farmed habitat, 0.2 acre of valley oak woodlands and savanna, and 5 acres of wetlands and other waters of the United States along Brushy Creek. Rock outcrop cliffs occur approximately 0.25 mile from the County Line Alignment. The natural gas pipeline relocation would temporarily affect 62 acres of annual grasslands and 22 acres of dryland farmed grasslands. The electric transmission line relocation would temporarily affect 0.4 acre of grasslands and 0.2 acre of agricultural lands. The petroleum pipeline relocation would temporarily affect 90 acres of grassland and 12 acres of blue oak woodland.

Special-Status Wildlife Species. Construction of the relocated Vasco Road and the utility relocations could affect several special-status wildlife species, including the San Joaquin kit fox; golden eagle; prairie falcon; burrowing owl; California tiger salamander; California red-legged frog; curve-footed hygrotus diving beetle; and three species of fairy shrimp: the California linderiella, vernal pool, and longhorn fairy shrimp.

The relocated Vasco Road would eliminate approximately 140 acres of occupied kit fox habitat based on a 2-mile distance from a sighting and 15 acres of occupied kit fox habitat based on a 2-mile distance from a fox scat. Up to 80 acres of occupied habitat based on the 2-mile distance criteria from a sighting and 20 acres of occupied habitat based on the 2-mile distance criteria from a fox scat would be temporarily disturbed along the natural gas pipeline. Approximately 90 acres of occupied habitat based on a 2-mile distance criteria from a sighting, would be temporarily disturbed along the petroleum pipeline

Table 8-4. Acres of Wildlife Habitats Affected by Construction of the Dam, Reservoir, Road, and Utility Relocation Facilities under the Los Vaqueros Reservoir Alternative

Wildlife Habitat	Facility						
	Los Vaqueros Dam, Reservoir, Spillway, and Quarry Sites	Los Vaqueros Pipeline	Relocated Vasco Road	Natural Gas Pipelines	Electric Transmission Line	Petroleum Pipelines	Total Acres Affected
Grassland	542	114	155	100	<1	90	1,002
Wetland	11	2	5	<1	0	<1	20
Valley oak woodland and savanna	180	3	<1	0	0	<1	185
Blue and live oak woodland	21	0	2	0	0	12	35
Agricultural and developed land	7	102	0	0	0	0	109
Dryland farmed grassland	737	5	37	0	<1	0	780

corridor. Construction could eliminate 46 potential dens and seven possibly active dens along the surveyed road corridor.

The road alignment could adversely affect kit fox individuals or populations by exposing the animals to vehicle-related mortalities, fragmenting habitat, and impeding dispersal and movement. In addition, construction could reduce grassland vegetative cover, the number of prey species, and habitat quality for kit fox. Potential or active den sites could be destroyed during construction activities and result in kit fox mortality or a reduction in habitat quality. Construction impacts also could include harassment during construction and disturbance from noise or ground vibrations in areas adjacent to construction sites.

Golden eagles and prairie falcons were observed foraging near the relocated Vasco Road. Burrowing owls were observed in the vicinity of the road alignment and suitable habitat occurs in annual grasslands along the alignment. Construction activities could result in direct mortality; disturbance of nesting birds; or desertion of nests, eggs, or young of these species. Construction activities could interfere with breeding birds at the Vasco Caves' rock outcrops, which provide nesting habitat for prairie falcons and perch and potential nest sites for golden eagles. A probable golden eagle nest tree (which was not used in 1990 or 1991) will be eliminated by the road alignment, but other suitable nest trees exist in the area and the presence of juvenile golden eagles at the rock outcrops in 1991 suggests that golden eagles nested successfully at an alternate nest site in 1991 (Beeman pers. comm.).

The relocated Vasco Road comes within 400 feet of one California tiger salamander breeding pond and would eliminate another stock pond used for breeding by California tiger salamanders. In addition to the loss of a breeding site, grading activities could kill salamanders in upland grassland habitat up to 1 mile from either stock pond. California tiger salamanders could also be killed on the road during the salamanders' breeding migrations from grasslands to the stock ponds.

The relocated road will adversely affect approximately 2.5 acres of California red-legged frog and curve-footed hygrotus diving beetle habitat along Brushy Creek.

The road alignment lies within 20 feet of unsurveyed rock outcrop pools that are potential habitat for fairy shrimp that could be disturbed by excavation, dust, and humans during construction.

Secondary Impacts: Vasco Road Relocation and Watershed Land Acquisition. Potential for growth-inducing impacts of the Vasco Road relocation were evaluated in detail by assessing potential land use changes near the proposed alignment and in areas to be acquired by CCWD (Jones & Stokes Associates 1991b).

Vasco Road Relocation. No newly proposed projects were identified along the relocated Vasco Road that were considered to have been induced by the road relocation proposal. Land use changes proposed for this area were either actively proposed or contemplated before the proposal for road relocation, and none of the projects appear dependent on the presence of the road.

The potential for future growth not yet proposed was also evaluated for lands along the relocated Vasco Road alignment. Potential exists for development of some areas adjacent to the road for retail trade (e.g., gas stations). In general, however, the steep terrain, heavy traffic on the proposed road, and lack of opportunities for road expansion all suggest that the road will accommodate existing traffic but will not have the capacity to handle substantial amounts of new traffic. As a result, the road will not likely lead to approval of new development in the vicinity. In addition, the presence of existing wind turbines or active leases for turbine development on much of the land near the alignment also would discourage residential or commercial development.

Any proposed future development along relocated Vasco Road would require a general plan amendment, preparation of an environmental document, consultation with agencies, and approval by the county board of supervisors. Significant impacts would have to be identified in the environmental document

and mitigation measures adopted. Requirements of the state and federal Endangered Species Acts would need to be met. Therefore, unrecognized and unmitigated impacts would not likely occur.

Watershed Acquisition. CCWD acquisition of the 17,000 acres of watershed lands would eliminate potential for development. The fact that the Bankhead Ranch development was approved by the county and was stopped only by CCWD land purchase demonstrates the potential for development under a no-action scenario and the protection benefits of CCWD acquisition.

The closure of Vasco Road as a main thoroughfare also would contribute to a reduction in growth potential in areas near the east side of Vasco Road just north of the watershed that would not be as easily serviced by the relocated Vasco Road. The terrain along the existing Vasco Road is also more amenable to development than the land along the relocated Vasco Road alignment.

Conclusions. By relocating Vasco Road to an area that is less suitable for development and by protecting lands that have been actively proposed and are suitable for future development, this alternative would contribute to a net reduction in potential for growth in the region.

Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance. The following discussion summarizes impacts common to all alternate configurations and states the significance of impacts and whether they can be reduced to less-than-significant levels. Table 8-4 summarizes affected habitat acreages.

Common Wildlife Species. Facilities common to all alternate configurations would eliminate 1,002 acres of grasslands, 780 acres of dryland farmed grasslands, 109 acres of agricultural lands, 185 acres of valley oak woodlands and savanna, 35 acres of blue and live oak woodlands, and 20 acres of wetlands (including one stock pond, 2.8 acres of Kellogg Creek, and 2.5 acres of Brushy Creek).

Impacts on common wildlife species that use grasslands and dryland farmed grassland would not be considered significant because the species and habitat are abundant regionally and statewide. The loss of 21 acres of blue oak woodlands is considered a less-than-significant impact because the loss is offset by the purchase, protection, and enhancement of over 4,000 acres of blue oak woodlands in the watershed.

Loss of 185 acres of valley oak woodlands and savanna would also be considered a less-than-significant impact on wildlife even though this habitat is important for wildlife species. Oak woodlands are common in the project area, and over 4,000 acres of blue oak woodlands would be purchased and protected by CCWD.

Loss of two stock ponds would also be a less-than-significant impact because this habitat type is common in the project area.

Filling the reservoir would result in direct mortality of common wildlife species, but the impacts would not be significant. The presence of a reservoir, however, also would provide habitat for other species, such as wintering bald eagles, migratory waterfowl, gulls, shorebirds, herons, and other waterbirds. This impact would be beneficial.

Special-Status Wildlife Species. Construction of this alternative would eliminate approximately 410 acres of occupied kit fox based on the 2-mile distance criteria from a sighting and 467 acres of occupied habitat based on the 2-mile distance criteria from an unidentified fox scat. In addition, 234 acres of occupied kit fox habitat (based on the 2-mile distance criteria from a sighting) and 20 acres of occupied habitat (based on the 2-mile distance criteria from a fox scat) would be temporarily disturbed. The temporary or permanent loss of foraging habitat within occupied kit fox habitat would be a significant impact and would require habitat compensation to reduce impacts to less-than-significant levels (U.S. Fish and Wildlife Service 1989).

Construction of this alternative could have a significant impact on denning kit foxes through direct mortality and disturbance during the breeding season. Construction-related impacts could be reduced to less-than-significant levels through mitigation measures, including conducting preconstruction surveys for potential and active kit fox dens, establishing buffer zones around potential or active dens, and excavating potential dens by hand.

Sixty-five potential dens and eight possibly active dens were present in the inundation zone and in the Vasco Road relocation corridor. The loss of potential and possibly active dens would not be a significant impact because dens do not appear to be limiting kit fox populations in the project area.

Kit foxes could be exposed to vehicle-related traffic, habitat fragmentation, and barriers to movement by the relocated Vasco Road. These impacts are significant but could be reduced to less-than-significant levels by fencing portions of the alignments and providing undercrossings. These measures were adopted by CCWD as part of the Vasco Road and utility relocation project.

Kit fox could be attracted to equipment, either for use as cover or in response to an increase in prey or human-related foods, thereby exposing them to construction-related or other hazards. Mitigation measures to reduce these potentially significant impacts to less-than-significant levels include avoiding excavation near dens, covering small excavated areas nightly, and carefully disposing of human foods.

Harassment by humans or dogs, illegal shooting, or mortality caused by vehicles could increase as a result of activities by construction personnel. These potentially significant construction-related impacts could be mitigated to less-than-significant levels by prohibiting possession of dogs and firearms by construction workers, controlling the timing of vehicle access and driving speeds, and establishing a program for all onsite employees to educate them about protection needs and endangered species laws.

Noise and ground vibrations caused by construction could displace kit foxes from nearby dens. Displacement could be detrimental, particularly if natal dens are abandoned. Displacement of individuals during the breeding season (December 1-May 31) could have the greatest impact in project areas where suitable habitat is already limited, but any displacement would be considered as take as defined by the federal Endangered Species Act. These potentially significant impacts could be mitigated to less-than-significant levels by establishing protective exclusion zones and reducing or prohibiting construction activities during the breeding season.

Postproject changes in habitat suitability include a loss of some foraging habitat in the inundation zone and increased numbers and types of human disturbance. Impacts on golden eagles would be less than significant because suitable nesting and foraging habitat is not limiting in the project vicinity and CCWD management policies to control rodenticide use in upland areas would reduce the potential for territory abandonment. In addition, CCWD has developed recreation guidelines to protect individual active eagle nests from recreation- and construction-related disturbances during the breeding season.

Reservoir construction could interfere with one known golden eagle nest. Because of the sensitivity of special-status raptors to human disturbance during the breeding season, any impact that disrupts breeding activities would be significant. To mitigate this impact to a less-than-significant level, a qualified biologist should conduct preconstruction surveys for active golden eagle nest sites near disturbance areas during the breeding season (March-June) and to determine any breeding activity. Establishing an appropriate buffer zone during the breeding season or seasonal restrictions on disturbing activities would reduce construction-related impacts to less-than-significant levels.

The relocated Vasco Road alignment is within 0.25 mile of the direct line of sight of a complex of rock cliffs. The rock cliffs are used by prairie falcons and other raptors for nest sites. Any impact that would cause rock cliff nest sites to be unsuitable for prairie falcons would be significant because this habitat type is unique and limited in the project area. Disruption of raptor nesting activities caused by increased human disturbance after road construction could be significant. CCWD has adopted measures as part of the Vasco Road and utility relocation project to reduce this impact to a less-than-significant level.

A burrowing owl colony and several individual owls were observed in spring along the relocated Vasco Road alignment. Owls also could be present in grasslands near all proposed project facilities. Prey species and burrow sites do not appear to be limiting to burrowing owl populations, and the elimination of small numbers of either prey species or burrow sites would not be a significant impact. Direct impacts on burrowing owls would be significant. Impacts could be reduced to less-than-significant levels by conducting preconstruction surveys during the breeding season to identify breeding birds and establishing buffer zones around all active burrows. If this is infeasible and an occupied burrowing owl den would be destroyed, a biologist should either block the entrance (after the owl is out) during the nonbreeding season or excavate the den by hand during the breeding season when eggs or young may be present.

Construction of these facilities would result in the loss of the population of California red-legged frogs in the portion of Kellogg Creek that would be inundated. Additional red-legged frog habitat would be lost in Brushy Creek. Red-legged frogs and western pond turtles downstream of the reservoir would be exposed to habitat degradation from construction activities, recreational facilities, and human disturbance. These impacts would be significant because these species are declining throughout much of their range. Impacts could be reduced to less-than-significant levels through habitat acquisition, enhancement, and management.

Populations of special-status amphibians and reptiles could be further reduced by the introduction of bullfrogs and fish species in the reservoir that would compete with and prey on them. This impact would be significant but could be reduced to a less-than-significant level by implementing a management plan that would sustain populations of special-status species by maintaining intermittent creeks with semipermanent pools. Bullfrogs and fish that require permanent water would not be as likely to survive.

Direct mortalities, loss of upland nesting habitat, and possible downstream habitat degradation for western pond turtles would be significant impacts because Kellogg Creek contains the only population in the watershed. These impacts could be reduced to less-than-significant levels by relocating western pond turtles out of the impact area and downstream; acquiring, enhancing, and managing habitat for pond turtles; and protecting downstream creek and upland habitat.

The potential loss of California tiger salamanders in upland habitat near breeding ponds adjacent to the inundation zone and along the relocated Vasco Road would be significant impacts. To reduce impacts on tiger salamanders from excavation to less-than-significant levels, ground disturbance near stock ponds should be minimized and staging areas should be placed at least 0.5 mile from stock ponds. In addition, winter surveys should be conducted to determine movement patterns of tiger salamanders to help direct the placement of culverts and drift fences.

The loss of a stock pond used by California tiger salamanders for breeding would be a significant impact. To reduce this impact to a less-than-significant level, construct a new pond near the lost pond.

Construction along Brushy Creek and the installation of culverts at creek crossings could adversely affect aquatic special-status species by altering stream channel morphology, preventing them from migrating upstream or downstream to seek suitable pool habitat when water levels recede, and degrading water quality. CCWD adopted mitigation measures as part of the Vasco Road and utility relocation project that would reduce this impact to less-than-significant levels.

Loss of intermittent water sources used by the curve-footed hygrotus diving beetle in the Los Vaqueros Reservoir inundation zone and in Brushy Creek would be a less-than-significant impact because temporary water bodies are abundant throughout the project area.

This alternative could adversely affect fairy shrimp in rock outcrop intermittent pools near the inundation zone and along the relocated Vasco Road through direct habitat loss, construction and recreation-related human disturbances, cattle grazing, and dust deposition and soil excavation during construction. Impacts could be reduced to less-than-significant levels by avoiding rock outcrop pools and preventing construction personnel, cattle, soil, and dust from entering the pools.

Reservoir Operation, Land Management, and Use. Purchase, protection, and improved grazing management of watershed lands would have a substantial beneficial impact on wildlife species and their habitats. In addition, CCWD's purchase and protection of a large area would contribute to the maintenance of regional habitat and corridors for wildlife movement to other protected lands (e.g., EBRPD's Round Valley Preserve, Morgan Territory Regional Preserve, Vasco Caves, and undeveloped private lands).

Reservoir operations could affect wildlife resources as a result of fluctuating water levels in the reservoir and in Kellogg Creek downstream of the reservoir. Nesting water birds could be adversely affected if reservoir levels are drawn down during the nesting season and predators gain access to nests or young birds. Presumably, the water bird species that ultimately use the reservoir for nesting will be those that can adapt to the water management regime. The reservoir would not be expected to act as a substantial population "sink" that could disrupt regional water bird nesting populations.

The reservoir would attract substantial populations of roosting gulls that forage at nearby landfills (H. T. Harvey & Associates 1991). This concentration, however, is not expected to pose serious disease or contamination problems (see Chapter 5, "Delta System Water Quality").

The loss of permanent pools in Kellogg Creek downstream of the reservoir is not expected to occur because CCWD will maintain adequate flow releases to provide pool habitat.

CCWD's policies regarding rodenticide use in the watershed would be a beneficial impact on wildlife species. CCWD's reduced and carefully coordinated use of rodenticides will substantially improve habitat values for the San Joaquin kit fox and other predators.

No significant adverse impacts are expected from CCWD's fuels and fire management program because CCWD will coordinate fire protection activities to ensure that important biological resources are protected during firefighting operations.

Significant impacts on wildlife could occur from clearing and leveling wind turbine sites and constructing access roads for wind energy development. CCWD cannot prevent wind energy development on its lands if it does not own the wind energy rights; however, it does have the limited authority to influence the locations of road or turbine pad sites to prevent erosion or other resource impacts.

Potential impacts on fairy shrimp and California tiger salamanders would be less than significant because the recreation development guidelines described in Chapter 2, "Alternatives Including the Proposed Action" would prevent such impacts.

Impacts on western pond turtles at the Kellogg Creek Recreation and Staging Area would be significant because it is unlikely that recreation-related impacts at this site could be avoided.

Impacts of Alternate Water Conveyance Configurations

The following discussion focuses on the additional incremental impacts that would result from implementing each of the alternate water conveyance configurations. Mitigation measures to reduce these impacts to less-than-significant levels would be identical to those described above under "Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance". The total impacts on wildlife habitats of each water conveyance configuration combined with facilities of the alternative common under each alternate configuration are presented in Table 8-5.

Habitat acreage presented in this section was calculated for a 150-foot-wide disturbance area. Portions of the alignments that supported habitat suitable for special-status wildlife species were surveyed to determine the potential for special-status species occurrence. A wider-than-needed corridor for construction was surveyed so that disturbance may be relocated within the corridors to minimize impacts

Table 8-5. Acres of Wildlife Habitats Affected by the Alternate Los Vaqueros Reservoir Alternative Configurations

Wildlife Habitat	Alternate Configuration						
	Rock Slough/ Old River No. 1	Rock Slough/ Old River No. 2	Rock Slough/ Old River No. 3	Rock Slough/ Old River No. 4	Rock Slough/ Old River No. 5	Rock Slough/ Old River No. 6	Rock Slough/ Clifton Court Forebay
Grassland	1,071	1,093	1,012	1,012	1,029	1,021	1,069
Wetland	24	26	22	28	21	21	27
Valley oak woodland and savanna	185	185	185	188	185	185	185
Blue and live oak woodland	35	35	35	35	35	35	35
Agricultural and developed land	168	196	292	277	213	252	134
Dryland farmed grassland	780	780	780	780	780	780	780

during the final project design. Preconstruction surveys would be conducted and survey results would be used to avoid impacts during the final project design and construction.

Most impacts from water conveyance facility construction are temporary, but the transfer reservoir, intake pumping plant, and electric transmission line tower or pole footings would eliminate habitat permanently. Impacts on special-status wildlife species can be minimized by siting these facilities to avoid a direct take of species and to minimize habitat loss. Temporarily disturbed areas would be revegetated and restored to preconstruction conditions.

Rock Slough/Old River No. 1 Configuration. The Old River No. 1 pipeline corridor would affect 69 acres of annual grassland, 4 acres of wetlands and other waters of the United States, and 59 acres of agricultural land (Table 8-6).

San Joaquin kit foxes have been observed within 1 mile of the western half of the pipeline (Jones & Stokes Associates 1990, McGinnis and Palmisano pers. comms.). Approximately 59 acres of occupied kit fox habitat would be temporarily disturbed along the pipeline, and 10 acres of occupied kit fox habitat would be permanently eliminated at the transfer reservoir site. Burrowing owls have been observed in grasslands on this alignment and could be killed or disturbed during the breeding season by construction activities.

No other special-status species were observed. The wetlands and other waters of the United States that could be temporarily disturbed during construction, especially creeks and stock ponds, are suitable habitat for the California red-legged frog, California tiger salamander, and western pond turtle.

The loss of occupied kit fox habitat and potential impacts on special-status species would be significant but could be mitigated to less-than-significant levels by implementing the mitigation measures described above under "Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance".

Rock Slough/Old River No. 2 Configuration. Construction of these facilities would affect 91 acres of grassland, 6 acres of wetlands and other waters of the United States, and 87 acres of agricultural land.

A San Joaquin kit fox was observed in spring 1991 near Byron and within 2 miles of the eastern half of the pipeline (McGinnis pers. comm.). Approximately 10 acres of occupied kit fox habitat would be temporarily disturbed along the pipeline. No occupied habitat would be permanently eliminated. No other special-status species were observed. Grasslands on the western end of the pipeline provide suitable habitat for the kit fox, burrowing owl, and California tiger salamander. The wetlands and other waters of the United States, especially creeks and stock ponds, are suitable habitat for California red-legged frogs, California tiger salamanders, and western pond turtles.

Impacts of these water conveyance facilities are similar to those described above for the Rock Slough/Old River No. 1 configuration. Potential impacts on special-status wildlife species could be reduced to less-than-significant levels by implementing the appropriate mitigation measures if the species are found during preconstruction surveys.

Rock Slough/Old River No. 3 Configuration. These facilities would affect 10 acres of grassland, 2 acres of wetlands and other waters of the United States, and 183 acres of agricultural land.

No special-status wildlife species were observed during surveys conducted for these facilities. The 10 acres of grassland provide suitable habitat for the San Joaquin kit fox, burrowing owl, and California tiger salamander. The wetlands and other waters of the United States, especially creeks and stock ponds, are suitable habitat for California red-legged frogs, California tiger salamanders, and western pond turtles.

Table 8-6. Acres of Wildlife Habitats Affected by Construction of Alternate Water Conveyance Facilities of the Los Vaqueros Reservoir Alternative and Associated Electric Transmission Lines

	Water Conveyance Facility						
Wildlife Habitat	Rock Slough/ Old River No. 1	Rock Slough/ Old River No. 2	Rock Slough/ Old River No. 3	Rock Slough/ Old River No. 4	Rock Slough/ Old River No. 5	Rock Slough/ Old River No. 6	Rock Slough/ Clifton Court Forebay
Grassland[a]	69	91	10	10	27	19	67
Wetland[b]	4	6	2	8	1	1	7
Valley Oak woodland and savanna	0	0	0	3	0	0	0
Agricultural and developed land	59	87	183	168	104	143	25

[a] Grassland acres are taken from Table 7-4 and include annual grassland and alkali grassland.

[b] Wetland acres are taken from Table 7-4 and include all alkali wetland communities minus alkali grassland, and drainages and stock ponds.

Potential impacts on special-status wildlife species could be reduced to less-than-significant levels by implementing the appropriate mitigation measures if the species are found during preconstruction surveys.

Rock Slough/Old River No. 4 Configuration. This configuration would result in disturbance of 10 acres of grassland, 8 acres of wetlands and other waters of the United States, 3 acres of valley oak woodland and savanna, and 168 acres of agricultural land. Impacts of these water conveyance facilities and appropriated mitigation measures are identical to those described above for the Rock Slough/Old River No. 3 configuration.

Rock Slough/Old River No. 5 Configuration. These facilities would result in disturbance of 27 acres of grassland, 1 acre of wetlands and other waters of the United States, and 104 acres of agricultural land. Approximately 3.5 miles of the pipeline route crosses agricultural land within 2 miles of a kit fox sighting. The 27 acres of grassland is considered occupied kit fox habitat based on the 2-mile distance from a fox scat. Approximately 17 of the 27 acres would be temporarily disturbed along the pipeline, and 10 acres would be permanently eliminated at the transfer reservoir site. Impacts of these water conveyance facilities and appropriate mitigation measures are identical to those described for the Rock Slough/Old River No. 1 configuration.

Rock Slough/Old River No. 6 Configuration. These facilities would result in disturbance of 19 acres of grassland, 1 acre of wetlands and other waters of the United States, and 143 acres of agricultural land. Approximately 3.5 miles of the pipeline route crosses agricultural land within 2 miles of a kit fox sighting. The 19 acres of grassland is considered occupied kit fox habitat based on the 2 mile distance from a fox scat. None of the 19 acres would be temporarily disturbed along the pipeline and 10 acres would be permanently eliminated at the transfer reservoir site. Impacts of these water conveyance facilities are similar to those described for the Rock Slough/Old River No. 3 configuration.

Rock Slough/Clifton Court Forebay Configuration. These facilities would result in disturbance of 67 acres of grassland, 7 acres of wetlands and other waters of the United States, and 25 acres of agricultural land.

San Joaquin kit foxes and burrowing owls have been observed along this alignment, which would temporarily disturb 57 acres of occupied kit fox habitat along the pipeline and permanently eliminate 10 acres of occupied kit fox habitat at the transfer reservoir site. Impacts of this configuration and appropriate mitigation measures would be identical to those described for the Rock Slough/Old River No. 1 configuration.

Kellogg Reservoir Alternative

Impacts expected under the Kellogg Reservoir Alternative are presented by project component. Refer to Table 8-7 for a summary of acreage losses expected under this alternative.

Facility Construction: Dams, Reservoir, and Related Facilities

Common Wildlife Species. Construction of the Kellogg Reservoir, spillway, saddle dams, and inlet/outlet works would eliminate 1,593 acres of annual grasslands; 5 acres of dryland farmed grasslands; 25 acres of agricultural and developed lands; 35 acres of wetlands, including eight stock ponds and 1.6 acres along 4.4 miles of Kellogg Creek and its tributaries; 8 acres of valley oak woodlands and savanna; and 36 acres of blue oak woodland.

Table 8-7. Acres of Wildlife Habitats Affected under the Kellogg Reservoir Alternative

	Facility			
Wildlife Habitat	Kellogg Reservoir and Related Facilities[a]	Old River No. 5 Water Conveyance Pipeline	Relocated Vasco Road	Total Acres Affected
Grassland	1,593	27	155	1,775
Wetland	35	1	5	41
Valley oak woodland and savanna	8	0	<1	9
Blue and live oak woodland	36	0	2	38
Agricultural and developed land	25	104	0	129
Dryland farmed grassland	5	0	37	42

[a] Kellogg Reservoir and related facilities include the dam, spillway, and Los Vaqueros pipeline.

Impacts on common wildlife species would be similar to those described above under the Los Vaqueros Reservoir Alternative. The Kellogg Reservoir Alternative would eliminate twice as many acres of grasslands as the Los Vaqueros Reservoir Alternative, 740 fewer acres of dryland farmed grasslands, and 177 fewer acres of valley oak woodlands. The Kellogg Reservoir Alternative would eliminate approximately 20 more acres of wetlands than the Los Vaqueros Reservoir Alternative.

Special-Status Wildlife. The Kellogg Reservoir site supports several special-status wildlife species, including the curve-footed hygrotus diving beetle, California red-legged frog, California tiger salamander, western pond turtle, and golden eagle. It also supports potential San Joaquin kit fox denning and foraging habitat.

San Joaquin Kit Fox. Construction of Kellogg Reservoir would permanently eliminate 1601 acres of occupied kit fox habitat, 1,081 acres would be 2 miles from a kit fox sighting, and 520 acres would be 2 miles from an unidentified fox scat. Construction and inundation would eliminate at least six potential kit fox dens in the Kellogg Reservoir inundation zone and could result in kit fox mortality and disturbance during the breeding season if kit foxes are present or move into the area before construction. Harassment by humans or dogs, illegal shooting, or vehicle-related mortalities could increase as a result of activities by construction personnel. Noise and ground vibrations caused by blasting and other construction activities could displace kit fox from nearby dens. Displacement could be detrimental, particularly if natal dens were abandoned.

Raptors. Raptors such as golden eagles, prairie falcons, burrowing owls, and wintering ferruginous hawks could lose approximately 1,598 acres of foraging habitat (1,593 acres of annual grassland and 5 acres of dryland farmed grasslands).

Golden eagles were frequently observed foraging in the inundation area. The Kellogg Reservoir would inundate a golden eagle nest last used in 1988. Alternative nest sites are apparently used by the pair that occupies this territory. The loss of foraging habitat in this territory is considered less than significant because suitable foraging and nesting habitat is not limiting in the project area or immediate vicinity.

No impacts on prairie falcons are expected because the nearest nest site is about 3 miles away and only a small proportion of their foraging habitat within the territory would be affected.

No burrowing owls were found in the inundation zone, but potential habitat exists in the annual grasslands. Disturbance and mortality could occur during construction activities if owls move into the area.

No impacts on wintering ferruginous hawks are expected because the hawks occur irregularly and are not expected to be affected by the loss of 14% of the overall foraging habitat in the watershed.

Other Species. Impacts on Alameda whipsnakes are not expected because they do not occur in the inundation zone or construction areas. Although tricolored blackbirds forage in the watershed during the breeding and wintering seasons, no impacts are expected because only a small proportion of available foraging habitat would be lost.

The reservoir would cause direct mortality and loss of habitat for California red-legged frogs and western pond turtles. California red-legged frogs spend most of their lives in riparian zones and use creek pools and ponds for breeding. Western pond turtles require permanent creek pools and ponds most of the year but nest in upland habitat about 0.25 mile from water bodies. Grading and inundation could also cause mortality and habitat loss for California tiger salamanders. California tiger salamanders use ponds and creek pools primarily for breeding. They spend most of their adult lives in upland areas up to 1 mile from a water body.

The Kellogg Reservoir would inundate 1.6 acres of suitable breeding habitat for California red-legged frogs in 4.4 miles of Kellogg Creek and its tributaries and would eliminate one stock pond that supports red-

legged frogs. The reservoir also would eliminate about 3 acres of upland habitat for red-legged frogs and possibly kill individuals of the species.

The loss of 4.4 miles (1.6 acres) of Kellogg Creek is a loss of 98% of the occupied western pond turtle habitat in the project area. In addition, the reservoir would eliminate approximately 1,400 acres of western pond turtle breeding habitat in upland grasslands.

The reservoir would inundate eight stock ponds, many of which are small and associated with alkali wetlands that do not hold water for very long.

Curve-footed hygrotus diving beetles were found at eight locations in the Kellogg Reservoir inundation zone, including one stock pond and seven alkali wetland pools and drainages.

Facility Construction: Recreation Facilities

The conceptual recreation plan was developed specifically for the Los Vaqueros Reservoir Alternative. If the Kellogg Reservoir Alternative were chosen, a specific recreation plan would be developed. Impacts on wildlife resources of recreation development and use are assumed to be similar to those described for the Los Vaqueros Reservoir Alternative because recreational activities allowed in the watershed would be similar. Refer to "Facility Construction: Recreation Facilities" in the "Los Vaqueros Reservoir Alternative" section above for a discussion of the expected impacts of recreational facility construction.

Facility Construction: Water Conveyance Facilities

The Kellogg Reservoir would use the Rock Slough/Old River No. 5 configuration conveyance facilities. Although the Los Vaqueros pipeline would be about 3 miles shorter, total impacts from habitat loss would not be less because the pipeline route to Los Vaqueros Reservoir would be inundated by Kellogg Reservoir. Impacts on wildlife resources and their habitat from the water conveyance facilities would be similar to those reported previously under "Rock Slough/Old River No. 5 Configuration" for the Los Vaqueros Reservoir Alternative.

Reservoir Operation, Land Management, and Use

Impacts on wildlife resources from the future operation, management, and use of the watershed are nearly the same as those described above for "Reservoir Operation, Land Management, and Use" for the Los Vaqueros Reservoir Alternative. One difference is that reservoir operation impacts on aquatic habitat in Kellogg Creek would be restricted to inundation. No permanent pools downstream of the inundation zone would be adversely affected by changes in flow releases or a drop in the water table.

Summary of Impacts: Vasco Road and Utility Relocation

Impacts of Vasco Road relocation would be the same as those identified for the Los Vaqueros Reservoir Alternative. Potential impacts of the natural gas pipeline, electric transmission line, and petroleum pipeline relocation included significant impacts on special-status wildlife species, such as fairy shrimp, California tiger salamander, California red-legged frog, western pond turtle, golden eagle, and burrowing owl. CCWD adopted mitigation measures as part of the Vasco Road and utility relocation project to reduce all potential impacts to less-than-significant levels.

Summary of Impacts and Conclusions of Significance

The following discussion summarizes expected impacts of the Kellogg Reservoir Alternative. The total wildlife habitat acreage affected by this alternative is shown in Table 8-7.

Common Wildlife Species. Construction of the Kellogg Reservoir Alternative would eliminate 1,768 acres of grasslands, 55 acres of dryland farmed grasslands, 129 acres of agricultural lands, 3 acres of valley oak woodlands and savanna, 36 acres of blue oak woodlands, and 37 acres of wetlands (including nine stock ponds, 1.6 acres of Kellogg Creek, and 2.5 acres of Brushy Creek).

As described above for the Los Vaqueros Reservoir Alternative, impacts on common wildlife species that use grasslands, dryland farmed grasslands, and agricultural lands would be a less-than-significant impact because the species and habitat are abundant regionally and statewide. The loss of blue oak woodlands would not be a significant impact.

The loss of oak woodland and savanna would be less than significant, although this habitat is important for wildlife species. Oak woodlands are fairly common in the project area.

The loss of eight stock ponds would be a less-than-significant impact because this habitat type is common in the project area. Filling the reservoir would result in direct mortality to individuals of common wildlife species. The impacts would not be significant. The presence of a reservoir also would provide habitat for other species, such as wintering bald eagles, migratory waterfowl, gulls, shorebirds, herons, and other water birds.

Special-Status Wildlife Species

San Joaquin Kit Fox. Construction of this alternative would eliminate approximately 1,221 acres of occupied kit fox habitat (based on the 2-mile-distance sighting criterion) and 545 acres of occupied habitat (based on the 2-mile-distance fox scat criterion). Seventeen acres of occupied kit fox habitat 2 miles from a fox scat would be temporarily eliminated along the pipeline corridor. An unknown amount of habitat along utility relocation alignments could be temporarily disturbed. The temporary or permanent loss of foraging habitat within occupied kit fox habitat would be a significant impact (U.S. Fish and Wildlife Service 1989) but would be reduced to a less-than-significant level by habitat acquisition and enhancement in watershed lands.

Fifty-two potential dens and seven possibly active dens were present in the Kellogg Reservoir inundation zone and in the Vasco Road relocation corridor. The loss of potential dens would not be a significant impact because dens do not appear to be limiting in the project area.

Construction activities and presence of construction personnel could cause direct mortality or harassment of kit foxes. These impacts include direct disturbance of den sites, exposure to vehicle-related mortality, and direct harassment by humans or dogs. These impacts are discussed in detail in "Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance" under the Los Vaqueros Reservoir Alternative. The impacts would be significant.

Special-Status Raptors. Kellogg Reservoir would inundate a golden eagle nest site and a substantial area of foraging habitat for golden eagles. This impact is would be less than significant for the reasons described under the Los Vaqueros Reservoir Alternative.

Because of the sensitivity of special-status raptors to human disturbance during the breeding season, any impact that disrupts breeding activities would be significant. To mitigate this impact to a less-than-significant level, a qualified biologist would be required to conduct preconstruction surveys for active golden eagle nest sites near the disturbance areas during the breeding season (March-June) and to determine any breeding activity. Establishing an appropriate buffer zone during the breeding season or

seasonal restrictions on disturbing activities would reduce construction-related impacts to less-than-significant levels.

Impacts of the relocated Vasco Road alignment on nesting raptors are the same as those discussed under "Summary of Impacts Common to All Alternate Configurations and Conclusions of Significance" for the Los Vaqueros Reservoir Alternative.

Special-Status Reptiles and Amphibians. Construction of this alternative would result in the loss of the project area population of California red-legged frogs in Kellogg Creek and the loss of red-legged frog habitat in Brushy Creek. In addition, red-legged frogs and western pond turtles upstream of the reservoir would be exposed to habitat degradation from construction activities, recreational facilities, and human disturbance. These impacts would be significant because these species are declining throughout much of their range. Impacts could be reduced to less-than-significant levels through habitat acquisition, enhancement, and management for red-legged frogs.

Populations of special-status amphibians and reptiles could be further reduced through competition and predation by introduced bullfrogs and fish species in the reservoir. This impact would be significant but could be reduced to a less-than-significant level by implementing a management plan that would sustain populations of special-status amphibians and reptiles by maintaining intermittent creeks with semipermanent pools. Bullfrogs and fish that require permanent water would not be as likely to survive.

The loss of 98% of the occupied western pond turtle habitat in the project area would be a significant impact because the species is localized in the project area and the proportion of project area habitat loss is great. Impacts could be reduced to less-than-significant levels by acquiring, enhancing, and managing potential western pond turtle habitat in the project area. In addition, an attempt could be made to relocate pond turtles to other habitats before construction to avoid any direct mortality.

Construction activities for the project could result in the loss of California tiger salamanders in upland habitat near breeding ponds adjacent to the inundation zone and along the relocated Vasco Road. This loss would be a significant impact. To reduce this impact to a less-than-significant level, ground disturbance near stock ponds should be minimized and staging and turnaround areas should be placed at least 0.5 mile from stock ponds. In addition, winter surveys should be conducted to determine movement of tiger salamanders to help direct the placement of culverts and drift fences.

The loss of a pond used by California tiger salamanders for breeding would be a significant impact to reduce this impact to a less-than-significant level, construct a new pond near the lost pond.

Construction along Brushy Creek and the installation of culverts at creek crossings could adversely affect aquatic special-status species by altering stream channel morphology, preventing the species from migrating upstream or downstream to seek suitable pools when water levels recede, and degrading water quality. Mitigation measures to reduce these significant impacts to less-than-significant levels are as described in "Summary of Impacts Common to All Project Configurations and Conclusions of Significance" under the Los Vaqueros Reservoir Alternative.

The loss of intermittent water sources used by the curve-footed hygrotus diving beetle in the Kellogg Reservoir inundation zone and in Brushy Creek would be a less-than-significant impact because temporary water bodies are abundant throughout the project area.

Impact significance and mitigation measures for fairy shrimp along the relocated Vasco Road are the same as those described for the Los Vaqueros Reservoir Alternative.

Reservoir Operation, Land Management, and Use. Purchase and protection of watershed lands for the Kellogg Reservoir Alternative would have a substantial beneficial impact on wildlife species and their habitat. In addition, CCWD's purchase and protection of a large area contributes to the maintenance of a

regional habitat reserve and corridors for wildlife movement to other protected lands (e.g., EBRPD's Round Valley Preserve, Morgan Territory Regional Preserve, Vasco Caves, and undeveloped private lands).

The benefits of watershed protection and improved management are similar to those described in detail under the Los Vaqueros Reservoir Alternative. The major difference between the Kellogg Reservoir and Los Vaqueros Reservoir Alternatives is that the Kellogg Reservoir Alternative would retain the 180 acres of valley oak woodland and savanna habitat that would be inundated by the Los Vaqueros Reservoir.

Reservoir operations could affect wildlife resources as a result of fluctuating water levels in the reservoir. Nesting water birds could be adversely affected if reservoir levels are drawn down during the nesting season and predators gain access to nests or young birds. Presumably, the waterfowl species that ultimately use the reservoir for nesting will be those that can adapt to the water management regime. The reservoir would not be expected to act as a substantial population "sink" that could disrupt regional waterbird nesting populations.

The reservoir would attract substantial populations of roosting gulls that forage at nearby landfills. This concentration, however, is not expected to pose serious disease or contamination problems (see Chapter 5, "Delta System Water Quality").

Desalination/EBMUD Emergency Supply Alternative

Impacts expected from construction of the desalination plant and brine disposal pipeline are summarized in Table 8-8. This alternative has several components: a blending facility, a pumping plant and pipeline, an EBMUD intertie pipeline to the Mokelumne Aqueduct, a filtration plant, and a waste disposal pipeline from the desalination plant to Suisun Bay.

Facility Construction: Desalination Plant

Construction of the desalination plant would eliminate approximately 100 acres of fallow agricultural fields. This habitat loss would not be expected to significantly affect common species or special-status wildlife species or their habitats.

Facility Construction: Brine Disposal Pipeline and Associated Water Conveyance, Intake, and Electric Transmission Line

The buried brine disposal pipeline follows the SR 4 right-of-way for most of the route and would not affect wildlife resources in these areas. At the eastern end, the pipeline would eliminate 51 acres of agricultural fields, 18 acres of annual grasslands, and 5 acres of dryland farmed grasslands. At the northwestern end, the pipeline crosses about 7 acres of brackish marsh habitat where it enters Suisun Bay near Pittsburg. Constructing a pipeline in the marsh habitat could eliminate or degrade additional acreage if it led to erosion or separated the marsh from tidal inundation by the Sacramento and San Joaquin Rivers.

Two special-status wildlife species, the salt marsh yellowthroat and Suisun song sparrow, were observed in the brackish marsh habitat during field surveys in May 1991. Three other special-status wildlife species have the potential to occur in the brackish marsh habitat: the California black rail, California least tern, and salt marsh harvest mouse. California black rails and salt marsh harvest mice would be susceptible to direct mortality during construction. Construction activities could also disrupt breeding activities of special-status species in adjacent areas.

Table 8-8. Acres of Wildlife Habitats Affected by Construction of the Desalination/EBMUD Emergency Supply Alternative

Wildlife Habitat	Facility				
	Desalination Plant[a]	Brine Disposal Pipeline	Rock Slough Intake Channel	EBMUD Intertie Pipeline	Total Acres Affected
Grassland	0	0	6	13	19
Agricultural and developed land	99	5	0	47	151
Dryland farmed grassland	0	0	0	5	5
Brackish marsh	0	7	0	0	7

[a] Includes solids lagoon.

Summary of Impacts and Conclusions of Significance

This alternative is expected to eliminate 18 acres of grasslands, 151 acres of agricultural and developed lands, 5 acres of dryland farmed grasslands, and 7 acres of brackish marsh habitat. Impacts on common wildlife species in annual grasslands, agricultural and developed lands, and dryland farmed lands would be less than significant because these habitats occur throughout the project area. The elimination of 6.7 acres of brackish marsh habitat would be significant because it supports a high diversity of marsh-adapted wildlife species and is declining throughout the state.

Loss of brackish marsh habitat, direct mortality, disturbance during the breeding season, and habitat fragmentation would be significant impacts on the five special-status wildlife species discussed above.

Middle River Intake/EBMUD Emergency Supply Alternative

This alternative would require construction of a water conveyance pipeline, intake site, electric transmission lines, and transfer reservoir pumping plant. Impacts expected under this alternative are described below and are summarized in Table 8-9.

Facility Construction: Water Conveyance, Intake, and Electric Transmission Line Facilities

Common Wildlife Species. Construction of this alternative would eliminate 28 acres of grasslands, 239 acres of agricultural and developed lands, 0.6 acre of wetlands, and 0.1 acre of riparian woodlands.

Special-Status Wildlife Species. This alternative could adversely affect California black rails during levee modification, reinforcement, and dewatering at the intake site on Woodward Island. California black rails have been found in midriver wetlands in the Middle River approximately 1.5 mile north of the intake site and could be present in midriver wetlands near the intake site. California black rails could occur in the project vicinity year round and would be adversely affected by habitat loss, direct mortality, or disturbance during the breeding season.

No other special-status wildlife species are expected to be affected by this alternative.

Summary of Impacts and Conclusions of Significance

Impacts on common wildlife species that occur in grasslands, agricultural and developed lands, wetlands, and riparian woodlands in the project area would be less than significant because these species are common in the project area.

Impacts on the California black rail would be considered significant but could be reduced to less-than-significant levels by avoiding midriver wetlands.

MITIGATION MEASURES

This section describes possible mitigation measures for each potential impact identified in the "Environmental Consequences" section. In some cases, details regarding the mitigation measure, such as the precise location of habitat management areas for special-status amphibians, has not yet been developed. These measures will be developed more specifically for the selected alternative in consultation with USFWS and DFG.

Table 8-9. Acres of Wildlife Habitats Affected by Construction of the Middle River Intake/EBMUD Emergency Supply Alternative

	Facility		
Wildlife Habitat	Middle River Pipeline and Related Facilities[a]	Electric Transmission Line	Total Acres Affected
Grassland	28	0	28
Wetland	1	0	1
Valley oak woodland and savanna	<1	0	<1
Agricultural and developed land	204	35	239

[a] Middle River pipeline and related facilities include intake, Orwood Pumping Plant, Neroly blending facility, and EBMUD intertie pipeline.

No-Action Alternative

No mitigation is required.

Mitigation Measures Common to All Project Alternatives

Potential Impacts on Wildlife Resources in Final Facility Locations and in Unsurveyed Portions of the Project Area

8-1: Conduct Site-Specific Surveys. CCWD has conducted surveys on thousands of acres in the project area; small portions of some of the conveyance and utility alignments have not yet been thoroughly surveyed. CCWD has extensive knowledge of the biological resources of the project area through various surveys, however, and the impact assessment assumes the potential for occurrence of important biological resources based on analysis of habitat conditions.

Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Most of the following mitigation measures are applicable to both alternatives. When a measure applies to only one of the alternatives, it is noted.

Impacts on San Joaquin Kit Fox

8-2: Conduct Preconstruction Surveys and Undertake Appropriate Precautions during Construction. Reservoir, road construction, and conveyance alignments could have a significant impact on kit fox. Implementation of the measures listed below for facilities located in kit fox habitat would reduce construction-related impacts on the San Joaquin kit fox to less-than-significant levels.

The measures described below are fully applicable to most project features. Because of the intensity and duration of dam construction, however, and because this area would be permanently lost once the reservoir is filled, alternative approaches to some of these measures may be developed to mitigate impacts and comply with the provisions of the state and federal Endangered Species Acts. Alternative approaches may be developed through consultation under Section 7 of the federal Endangered Species Act.

- Biologists experienced in identifying San Joaquin kit fox dens should survey suitable habitat (i.e., intact grassland habitats, oak savannas, and nearby disturbed areas) in construction zones within 30 days before the start of construction. These surveys would be conducted once the project impact areas are clearly marked. Surveys would be conducted as previously described in the Stage 2 EIR/EIS Technical Report (bound separately). Related project sites, such as staging areas and access roads, would also be surveyed. Any potential dens found would be conspicuously marked or collapsed, and attempts would be made to determine kit fox presence with spotlighting and scent stations as previously described. Additional detail is provided below.

- Construction activities would not occur within an exclusion zone established around an active or natal kit fox den between early December and late May to ensure that kit fox are not disturbed when pups may be in or near the dens. The size of the exclusion zone would be determined in consultation with USFWS and DFG.

- If destruction of a potential den would be considered unavoidable, it would be excavated by hand under a biologist's supervision before construction to ensure that no kit fox are present. A video endoscope could also be used to determine whether potential dens are occupied. Use of the scope would eliminate the need to excavate unoccupied dens.

- To facilitate practical construction of the dam, potential dens could be excavated during the nonbreeding season to prevent fox use. Surveys would then be conducted within 30 days of construction to ensure that kit foxes have not moved into new burrows. In other areas, buffers around potential dens would be marked using stakes and flagging to alert construction personnel to avoid these areas. Appropriate buffer distances would be developed through consultation with USFWS and DFG.

- Vehicle traffic would be restricted to designated access roads and the immediate vicinity of construction sites. Vehicle speeds would be restricted in most project areas, except on county roads and state and federal highways. This is especially important at night when kit fox are most active. To the extent possible, night-time construction would be minimized.

- No pets or firearms would be permitted on construction sites so as to avoid harassment or killing of kit fox. Construction workers would leave the construction area and adjacent potential kit fox habitat each night to minimize disturbance to actively foraging animals unless night work is required.

- Construction excavations deeper than 2 feet that could trap foxes would be either fenced, covered, or filled at the end of each working day or have escape ramps provided.

- All construction pipes, culverts, or similar structures with a diameter of 4 inches or greater that are stored at a construction site more than 8 hours would be inspected for kit fox before the pipe is subsequently buried, capped, or moved in any way. All pipes, when possible, should be stored on pipe racks at least 3 feet off the ground or have their ends capped to reduce kit fox access.

- All food-related trash would be deposited in closed containers and regularly removed from work sites.

- Rodenticide or herbicide use would be restricted in project areas where kit fox are known to occur. If rodent control must be conducted, zinc phosphide should be used because of its proven low risk to kit fox.

- All onsite construction supervisors would be required to attend a workshop on special-status species protection needs. The program should include a description of the San Joaquin kit fox and its habitat needs, its occurrence in the project area, its status and protection under the Endangered Species Act, and the measures being taken to reduce impacts on the species during project implementation. The supervisors would subsequently relate these concerns to their subordinates. A fact sheet conveying this information would be prepared for distribution to all contractors and their employees. All the above provisions would be included in construction contracts, and meetings would be conducted with construction crew members. An environmental monitor would be responsible for evaluating and documenting contractor compliance with mitigation measures.

- Any contractor or employee who inadvertently kills or injures a San Joaquin kit fox or who finds a dead, injured, or entrapped San Joaquin kit fox should report the incident immediately to his or her immediate supervisor who will follow an approved plan to contact USFWS.

8-3: Compensate for Loss of San Joaquin Kit Fox Habitat. San Joaquin kit fox habitat that would be temporarily disturbed or permanently lost by project activities would be compensated to offset the habitat value lost.

The temporary loss of grasslands in occupied kit fox habitat would be mitigated partially by restoration following construction. On completion of construction, all areas subject to temporary ground disturbance, including storage and staging areas, temporary roads, and pipeline corridors, would be recontoured if necessary and revegetated to promote restoration of the area to preproject conditions. Areas temporarily disturbed but revegetated would be subject only to habitat compensation levels that reflect the temporary nature of the habitat loss.

The accomplishment of measures in temporarily disturbed areas permits use of a lower habitat compensation ratio than is required for areas permanently lost. The acreage ratio is typically 1.1:1 (see "Disturbance of Common Natural Communities and Other Habitats during Construction - Restore Disturbed Sites" under the "Mitigation Measures" section in Chapter 7).

Permanent and temporary habitat losses would be compensated through acquisition and enhancement. It is likely that a greater area than that affected by the project would need to be acquired, enhanced, and protected to fully compensate for habitat losses. The amount of habitat to be permanently protected would be determined in consultation with USFWS and will be calculated at different ratios depending on whether the loss is temporary or permanent. For this project, USFWS and DFG prefer that acquired lands be contiguous with occupied kit fox habitat. A second consideration in meeting the mitigation ratio is the suitability of lands acquired.

USFWS has stated that compensation should be conducted separately for two habitat categories, both of which it considers occupied habitat. These categories distinguish between differences in evidence of kit fox use. The first category includes suitable habitat within 2 miles of a kit fox sighting. The second category includes the area within 2 miles of an unidentified fox scat (Simons pers. comm.).

Under the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives, CCWD would acquire approximately 11,050 acres of suitable kit fox habitat within the surrounding watershed and along relocated Vasco Road. These lands provide substantially greater acreage then required to compensate for temporary disturbances, and for habitat losses under both definitions of occupied and possibly occupied kit fox habitat to meet the 3:1 ratio requirements of USFWS. In addition to watershed land acquisitions, CCWD may consider acquiring lands near the known kit fox natal den in the Herdlyn watershed adjacent to the Kellogg Creek watershed.

Efforts to enhance mitigation areas may include installing artificial dens, prohibiting rodenticide use, and modifying grazing management to benefit prey populations.

8-4: Install Fencing and Provide Undercrossings within Occupied San Joaquin Kit Fox Habitat. The relocated Vasco Road could increase kit fox road mortalities, impede movement, and fragment habitat. To reduce these impacts to less-than-significant levels, several mitigation measures were included in the previous Vasco Road EIR. As a result of subsequent consultation with USFWS and DFG, the mitigation approach has changed regarding fencing of the relocated Vasco Road. The new mitigation design includes a fence design that allows kit fox passage, but excludes passage by coyotes and large dogs, as described below. No changes have been made in the culvert undercrossing specifications identified in the Vasco Road and Utility Relocation Project EIR.

The newly adopted fence design is approximately 4 feet high, with 6- to 8-inch hogwire on the bottom and three strands of barbed wire across the top. The 6- to 8-inch hogwire would allow kit foxes to pass through the fence easily but will exclude or discourage larger canids such as coyotes. USFWS has requested that the fence be set back 50-100 feet from the road. A setback would allow kit foxes a safe movement buffer if they cross the fence onto the road right-of-way. Buffer distances would vary depending

on the topography adjacent to the road. Smaller buffers may be adequate in areas of steeper terrain. The need for and width of buffer areas will be finalized with agencies during the endangered species consultation.

Impacts on Special-Status Raptors

Impacts on Golden Eagle and Prairie Falcon Nest Sites. Mitigation measures were previously adopted for Vasco Road realignment. The following discussion addresses new measures for Vasco Road and measures for other project components. The following mitigation measures would reduce impacts on raptor nest sites to less-than-significant levels.

8-5: Establish Temporal or Physical Buffer Zones around Active Nest Sites during Construction. The following mitigation measures would reduce potential impacts on nesting golden eagles or prairie falcons near the inundation zone and along the relocated Vasco Road to less-than-significant levels:

- Before the breeding season (September-December), remove the valley oak tree with a stick nest (in golden eagle territory 4) on the Vasco Road realignment. Removing the tree would reduce the potential for disturbance during the breeding season at the site to a less-than-significant level.

- Before any construction that would occur during the raptor breeding season (March-June), a qualified biologist will survey oak woodlands and suitable rock outcrops within 0.5 mile of construction sites to locate any nesting golden eagles or prairie falcons. The actual survey area buffer distance may vary and depends on topography, whether the nest is within direct line of sight of the disturbance, and type of disturbance, and may be greater or less than 0.5 mile. Identifying active nests and maintaining the appropriate buffer from those nests during construction would reduce impacts to less-than-significant levels.

- Blasting during construction would require a buffer distance of at least 1 mile to be effective, depending on the topography. If blasting is required within 1 mile of an active nest, impacts could be reduced to less-than-significant levels by avoiding blasting between the period before adult birds arrive at the nest site and after the young are several weeks old (generally March-May). The exact timing would depend on the nesting phenology at the specific site, as determined by a qualified biologist.

- Nonessential activities of construction personnel would be prohibited within 0.5 mile (or other established buffer) of any active nest.

Impacts on Burrowing Owls

The following mitigation measures would reduce impacts on burrowing owls to less-than-significant levels in the project area.

8-6: Conduct Preconstruction Surveys. Qualified biologists should conduct preconstruction surveys for active burrowing owl nests in the breeding season (March-September) when the young are still dependent on the adults and in the burrows. Surveys should also be conducted during the rest of the year for burrowing owls. An appropriate buffer zone would be established around any active burrows during construction.

If a known burrowing owl nest is found in the construction impact area, delay construction until the young have left the nest. In consultation with DFG and depending on the breeding stage (i.e., outside of the breeding season and only adults are present), the den may be excavated.

Impacts on Aquatic Wildlife Species

Temporary Loss of Kellogg Creek Habitat Downstream of the Reservoir during Reservoir Construction

8-7: Maintain Sufficient Flows in Kellogg Creek to Ensure Preservation of Pools. The temporary loss of permanent pools in Kellogg Creek downstream of the Los Vaqueros Reservoir construction area would be reduced to less-than-significant levels by maintaining sufficient flow releases during construction to ensure permanent pool habitat.

Impacts on Brushy and Kellogg Creeks Habitat Quality during Construction

8-8: Prevent Degradation and Hydrologic Modification of Brushy and Kellogg Creeks. Mitigation measures that would be implemented to reduce impacts on the aquatic resources of Brushy and Kellogg Creeks to less-than-significant levels are discussed in "Water Quality":

- Obtain a DFG Streambed Alteration Agreement to construct the creek crossings. The permit would specify construction conditions to minimize impacts.
- Restrict construction of stream crossings to low-flow periods (generally June-September) to minimize erosion impacts on aquatic species except in the inundation area.
- Prohibit use of surface water from project area water bodies for construction-related activities.
- Prohibit operation of construction equipment in flowing water except in the inundation area.
- Prohibit construction-related byproducts (e.g., oil and cement) from entering the creek.
- Cover exposed soil in temporarily disturbed creek beds with hay and straw to reduce erosion in graded areas.
- Design stream crossings so that approaches are at right angles to the stream to the extent practicable.
- The following criteria should be employed in selecting the specific location of the crossing site to the extent practicable:
    - there should be no sudden increase in gradient or water velocity for at least 100 feet above, below, or at the crossing location;
    - the channel gradient should be as near to zero as possible; and
    - the stream channel should have a similar alignment for at least 100 feet above and below the crossing.

Permanent Loss of Aquatic and Wetland Habitat In Kellogg and Brushy Creeks. The loss of Kellogg and Brushy Creek riparian and associated upland habitat could be fully compensated for by implementing measure 7-6, involving enhancement and restoration of existing habitats (see Chapter 7,

"Vegetation Resources"). Approximately 78 stock ponds and many miles of drainages outside the reservoir inundation area are available to be used to compensate for lost habitat values.

Impacts on California Red-Legged Frogs. The loss of California red-legged frog habitat in drainages and stock ponds would be fully compensated for by enhancing and managing existing habitats as described above under "Loss of Aquatic Habitat in Kellogg and Brushy Creek".

8-9: Relocate Red-Legged Frogs. To reduce construction impacts on special-status species, individuals should be live-trapped in affected areas before construction and during the appropriate season. The species would be relocated in the habitat management area mentioned above. Voucher specimens will also be collected for historical records at DFG's request (Brode pers. comm.).

Impacts on California Tiger Salamanders

8-10: Avoid or Replace California Tiger Salamander Habitat. Potentially significant impacts of the Vasco Road relocation include increases in road mortality, population isolation, interference with migration to a breeding site and loss of a breeding pond. These mitigation measures have been modified to reflect changes in impacts attributable to the relocated Vasco Road alignment subsequent to the certification of the EIR (Jones & Stokes Associates 1990). Winter surveys of individual sites will be conducted near breeding sites that will be adversely affected by the project to determine areas of upland habitat use and migration routes. If significant impacts are identified, they could be reduced to less-than-significant levels by placing undercrossings and specially designed salamander exclusion fences in appropriate areas, such as in drainage ways near breeding sites. Survey information will be used to identify locations to place culverts and salamander fences.

Constructing a new stock pond as close as possible to the stock pond that would be affected along Vasco Road would reduce the impact of loss of a breeding site to less than significant. The replacement stock pond should be built the year before construction and larval salamanders should be trapped and moved to the new pond.

Impacts on Western Pond Turtles

8-11: Relocate Western Pond Turtles. Implementing the following actions would reduce impacts on western pond turtles to less-than-significant levels. A qualified biologist should trap western pond turtles in the portions of Kellogg Creek that would be disturbed during reservoir construction. Trapped turtles should be relocated to existing suitable habitat within Kellogg Creek or other suitable locations in the project area that would not be disturbed.

Impacts on Fairy Shrimp

8-12: Avoid Rock Outcrop Intermittent Pools. The Los Vaqueros Reservoir inundation zone is very close to rock outcrops that are one of three known isolated fairy shrimp locations in the project area. Impacts could be reduced to less-than-significant levels by discouraging recreational use of this site by posting no trespassing signs, patrolling the area, and prohibiting construction of recreation facilities nearby.

Rock outcrop vernal pools occur within 40 feet of the relocated Vasco Road. These impacts were identified after refinement of the road alignment subsequent to certification of the Vasco Road and Utility Relocation Project EIR. Potential impacts from habitat degradation could be reduced to less-than-significant levels by avoiding the pools during construction, prohibiting casual use by construction personnel, building a permanent retaining wall to keep runoff and soils from entering the pools, covering pools during the dry season if construction dust is prevalent, and implementing standard dust abatement procedures to protect the pools from airborne dust.

Desalination/EBMUD Emergency Supply Alternative

Restore Brackish Marsh Habitat

The loss of brackish marsh habitat would be reduced to a less-than-significant level by implementing measure 7-24 described in the "Mitigation Measures" section in Chapter 7, "Vegetation Resources".

8-13: Minimize Impacts on Special-Status Wildlife Species

If this alternative is chosen, surveys should be conducted to determine the presence of the federally endangered salt marsh harvest mouse, least tern, and the state-threatened California black rail. If these species are present, reroute the alignment to avoid direct mortalities and the potential violation of the take prohibitions under the state and federal Endangered Species Acts.

In addition, conduct preconstruction surveys for the five potential special-status species during the appropriate breeding season. If any of the species are nearby and could be disturbed by construction, postpone construction activities until the breeding season is over.

Middle River Intake/EBMUD Emergency Supply Alternative

8-14: Prevent Impacts on California Black Rails

Preconstruction surveys should be conducted for the California black rail in nearby midriver wetlands. Construction activities should be avoided in midriver wetlands. If black rails are breeding near the project site, and it is determined they would be disturbed by construction activities, construction activities should be postponed until the breeding season (March through July) is over.

Chapter 9. Visual Resources

AFFECTED ENVIRONMENT

Visual resources are elements or combinations of elements in the landscape, such as a landform, water feature, vegetation pattern, or structure (U.S. Soil Conservation Service 1978). The quality of a visual resource is defined as the "visual significance given to a landscape determined by cultural values and the landscape's intrinsic physical properties" (Smardon et al. 1986). Assessing the quality of visual resources, therefore, involves defining important physical properties of visual resource elements, identifying the degree to which the resources are viewed, assessing the visual integrity of the landscape, and identifying a landscape's ability to absorb a new feature while maintaining its visual integrity. The perceived quality of a visual resource element can vary considerably between observers and can depend on the regional context of the element and the direction and distance from which observers view the area.

Preserving the scenic resources of Contra Costa County is an important general plan goal. The county's scenic vistas are major contributors to the perception that the county is a desirable place to live and work. Preserving the quality of visually sensitive features of the landscape would help preserve and reinforce the county's rural landscape character and balance the effects of development (Contra Costa County Community Development Department 1991).

The transportation and circulation element of the county general plan designates scenic routes that have rural and natural scenic qualities that should be protected. The land use element identifies goals and policies for development and project design that reinforce the aesthetic character of the county, encourage the uniqueness of its communities, and enhance scenic quality. The open space element identifies goals for preserving and protecting areas of high scenic value; scenic ridges, hillsides, and rock outcroppings; and scenic qualities of the shorelines and other elements of the Bay and Delta systems.

Terminology and Approach for Visual Resource Analysis

Definition of Terms

Various terms and concepts are used in this analysis to describe and evaluate visual resources and visual quality:

- **Landscape character zones.** Landscape subregions distinguished by generally congruent physiographic characteristics and land use patterns.
- **Visual distance zones.** Divisions of a particular landscape viewshed based on the spatial separation between observer and subject.
- **Visibility.** The geographic extent of a resource and the legibility of its features as seen by an observer from a particular location.
- **Intactness.** The visual integrity of the natural and built landscape and its freedom from encroaching elements.

- **Visual absorption capability.** A measure of the landscape's ability to absorb alteration yet retain its visual integrity and a measure of the landscape's susceptibility to visual change (Anderson et al. 1979).

Approach

Much of the general method for visual analysis has been developed by federal land management agencies such as the U.S. Bureau of Land Management (BLM), U.S. Forest Service (USFS), U.S. Soil Conservation Service (SCS), and the Corps. This visual resource evaluation determines whether resources may be affected by project alternatives and provides the basis for the impact mechanisms and significance criteria identified below in the "Environmental Consequences" section.

Broad landscape character zones of the project region provide a context for comparing more specific visual resource areas. Relative uniqueness or scarcity of visual elements within the landscape can be determined by comparing these elements with the regional visual context.

Visual quality is assessed based on a judgment of the uniqueness or scarcity of elements within the broader landscape character zone, evaluation of specific visual resource characteristics, and site intactness. Visual quality ratings for project alternative sites are quantified by adding values assigned to a site's visual resources and intactness. Visual resources are evaluated based on landform diversity, the importance of surface water, and vegetation diversity. The intactness of a site is the most important determinant of visual quality because it takes into account many visual considerations, including landscape unity, compositional harmony, encroachment of incongruous features, and site structures or artificial elements.

Visual quality ratings are determined according to the following formula:

$$VQ = L + V + W + (2I)$$

where VQ = visual quality rating, L = landform diversity, V = vegetation diversity, W = importance of surface water, and I = landscape intactness.

The visibility of project alternative sites is also assessed qualitatively and used to determine visual resource sensitivity below in the "Environmental Consequences" section. Measuring the relative visual absorption capabilities of a landscape, within the context of a site's visual quality and visibility, provides a qualitative measure of the effect that a particular action could have on a visual resource element.

Regional Visual Character

The landscape of eastern Contra Costa County is primarily rural and pastoral with a strong natural character. This visually diverse region contains scenic elements that are representative of California's northern Coast Ranges and Delta landscapes, including grass-covered grazed hills, prominent ridges, oak woodlands, orchards, row crops, Delta wetlands, and meandering watercourses. The county general plan indicates that the visual qualities of both natural and constructed landscapes are of major importance and identifies Delta sloughs; narrow, wooded canyons; and dramatic panoramic views from peaks and ridges as scenically important elements.

Landscape Character Zones

To provide a context for describing and assessing visual resources, landscape character zones have been defined for the region containing the study area.

Examination of aerial photographs; U.S. Geological Survey (USGS) 7.5-minute series topographic maps; and county general plan maps for soils, geology, slope, and land use patterns indicates that four landscape character zones encompass the affected environments of the project alternatives (Figure 9-1). Landscape character zones are defined as the inland hills, the Delta lowlands, the upland plain, and the Pittsburg/Antioch plain.

The landform of the inland hills character zone generally consists of rolling and steep hills, rock outcrops, ravines, and valleys. Elevations range from approximately 100 feet to 3,849 feet above mean sea level at the summit of Mt. Diablo. Ridge lines are visually prominent landform features. Surface water is uncommon and vegetation consists mostly of extensive annual grasslands. Oak woodlands, chaparral, wooded riparian corridors, and scattered oaks are also prevalent. Land uses consist predominately of grazing and open space, with some areas developed for dryland farming, recreation, rural residences, and windfarm operations.

The Delta lowlands character zone is generally flat and consists of lands ranging in elevation from below sea level to about 10 feet above mean sea level. Land uses are predominantly low-growing agricultural row crops, pastures, and some recreational uses, with water (irrigation ditches, rivers, ponds) being a visually important element. Remaining natural vegetation consists mostly of grasslands, riparian areas, and wetlands. With the exception of the large Discovery Bay planned development, residential land uses are sparse, rural, and usually associated with farm operations.

The upland plain character zone is a gently sloping alluvial plain that forms a transition between the low, flat Delta lowlands character zone and the hilly, topographically diverse inland hills zone, which is predominately grasslands. This zone ranges in elevation from about 10 to 100 feet above mean sea level. Natural vegetation has been largely replaced or altered by agricultural, residential, and commercial land uses. Remaining vegetation in this zone consists of grasslands, some scattered oaks, and a few riparian areas. Land uses consist mostly of orchards, row crops, and rural to low-density residential development. This zone contains Oakley, Brentwood, and Byron, which are growing communities experiencing rapid conversion of agricultural lands to residential and other suburban uses.

The Pittsburg/Antioch plain character zone, lying in the northern reaches of the project area, is similar to the inland hills character zone, but is distinguished primarily by its proximity to the open water of the San Joaquin River and Suisun Bay and its more intensive urban land uses.

Kellogg Creek Watershed

Table 9-1 presents a qualitative assessment of the visual quality of the Kellogg Creek watershed.

Visual Resources

The Kellogg Creek watershed is located in the inland hills character zone. The watershed is rural and pastoral with a strong natural character. The landscape consists largely of grass-covered rolling hills and valleys, oak woodlands, meandering riparian corridors, and steep chaparral-covered slopes. Because of its generally undeveloped nature, the watershed generally has high scenic value. Bedrock outcrops, remnant and recent mud and debris flows, and small alluvial fans are scattered topographic elements that provide visual variety. Elevations range from about 150 feet above mean sea level in the northern valley portion of the watershed to about 2,300 feet along the watershed's west ridge. A northwest-southeast ridge running through the southwest portion of the watershed is designated as a scenic ridge by the county (Figure 9-1). Typically, surface water occurs only as scattered small reservoirs and stock ponds and as seasonal flows in Kellogg Creek and other small drainages.

Table 9-1. Visual Quality Assessment of Areas Affected by the Project Alternatives

Affected Area	Visual Resources[a]				
	Landform Diversity (x1)	Surface Water Importance (x1)	Vegetation Diversity (x1)	Intactness[a] (x2)	Visual Quality[b]
Contra Costa Canal Alignment	L	M	L	M	L^{8}
Kellogg Creek watershed					
Northern area (Kellogg Reservoir area)	H	L	M	H	H^{12}
West of Vasco Road	H	L	H	H	H^{13}
East of Vasco Road	H	L	L	L	L^{7}
Intake areas					
Old River No. 1	L	H	L	H	M^{11}
Old River No. 2 and No. 5	L	H	L	H	M^{11}
Old River No. 3	L	H	L	H	M^{11}
Old River No. 4	L	H	L	H	M^{11}
Old River No. 6	L	H	L	H	M^{11}
Clifton Court Forebay	L	H	L	L	L^{7}
Middle River	L	H	L	H	M^{11}
Pipeline alignments					
Old River No. 1	M	L	L	M	L^{8}
Old River No. 2	L	L	L	M	L^{7}
Old River No. 3	L	L	L	M	L^{7}
Old River No. 4	L	L	L	M	L^{7}
Old River No. 5	L	L	L	M	L^{7}
Old River No. 6	L	L	L	M	L^{7}
Clifton Court Forebay	L	L	L	M	L^{7}
Middle River	L	L	L	M	L^{7}
Transfer reservoirs (including electric transmission lines)					
Kellogg	M	L	M	H	M^{11}
Camino Diablo	M	L	M	M	M^{9}
PG&E Hill	L	L	L	M	L^{7}
Electric transmission line alignments					
Old River No. 1	L	L	L	M	L^{7}
Old River No. 2 and No. 5	L	L	L	M	L^{7}
Old River No. 3	L	L	L	M	L^{7}
Old River No. 4	L	M	L	M	L^{8}
Old River No. 6	L	L	L	M	L^{7}
Middle River	L	M	L	M	L^{8}
Neroly blending facility site	L	L	L	M	L^{7}
Los Vaqueros pipeline alignment	H	L	M	M	M^{10}
Desalination plant					
Intake channel	L	L	L	M	L^{7}
Plant site	L	L	L	M	L^{7}
Brine disposal pipeline alignment	L	L	L	L	L^{5}
Electric transmission line alignment	L	L	L	M	L^{7}
Intertie pipeline alignment	L	L	L	M	L^{7}

Table 9-1. Continued

Notes: H = high.
M = medium.
L = low.

[a] Qualitative values correspond with numeric values as indicated below:

Landform Diversity	Surface Water Importance	Vegetation Diversity	Intactness
H = 3	H = 3	H = 3	H = 3
M = 2	M = 2	M = 2	M = 2
L = 1	L = 1	L = 1	L = 1

[b] Visual resources + intactness = visual quality.

Visual quality scale = L^5, L^6, L^7, L^8/M^9, M^{10}, M^{11}/H^{12}, H^{13}, H^{14}, H^{15}.

Vegetation types and patterns consist of scattered and dense oak woodlands, often on north- and east-facing slopes and in valley bottoms, meandering linear riparian forests along major drainages, chaparral on some slopes; and annual grasslands throughout the area. Whereas the western portion of the watershed contains a diverse mix of vegetation types and patterns, the portion east of Vasco Road consists mostly of annual grasslands. The valley bottoms contain individuals and stands of mature valley oaks, some of which are of visual interest and value.

Dominant structural elements in the watershed are scattered residences and appurtenant features; occasional large agricultural structures, groups of structures, and equipment; paved and unpaved roads; road cuts; fence lines; wooden-pole electric transmission lines; lattice tower electric transmission lines; and rows of wind turbines. Grazed grasslands are the dominant element of land use patterns throughout most of the lower elevations and rolling hills of the watershed.

Landscape Intactness

The current landscape is highly intact, with few elements that intrude or detract from its character and quality. Elements that support the area's intactness (i.e., appear fitting and representative of its character) generally represent and reinforce the area's rural, pastoral character and include most small-scale agricultural structures and small clusters of structures; occasional residences that are not near or on ridge lines; wooden-pole fences; winding, narrow roads that adhere to the natural landform; and, occasionally, wooden-post electric transmission lines.

Elements that disrupt the area's intactness and pastoral and natural character include lattice tower electric transmission lines, large road cuts and fills, large structures, wind turbines (especially large groupings), most structures set on or near ridge lines, and linear elements such as fences and erosion scars that do not follow the natural landform. Poor air quality, as distinguished from natural haze and fog, may also detract from the area's visual quality.

The overall visual quality of the watershed is common to the interior Coast Ranges landscape and appears not to possess many unique or distinct visual characteristics within the context of the region.

Visibility

Views of the watershed from surrounding areas are generally limited to a few locations at the watershed's western edge along Morgan Territory Road and from the Morgan Territory Regional Preserve operated by EBRPD. Views from these areas are of the broad Kellogg Creek valley and dominant eastern ridges and rolling hills to the east. Unique and high-quality views from the watershed ridges are primarily to the northwest toward Mt. Diablo and other prominent ridges.

Because of the rolling and varied topography, vistas and viewing opportunities vary throughout the watershed. In the lower elevation zones throughout most of the watershed, views are generally limited to foreground and middle ground distances because of the surrounding steep slopes and ridges. With the exception of views from the watershed's central valley, views often tend to be focused and framed, creating a strong sense of enclosure for viewers. In contrast, views from the watershed's northern-most valley and higher-elevation upper slopes and ridgetops are expansive and include broad, sweeping vistas of the surrounding landscape, including the background visual distance zone.

Visibility is enhanced by low grassland cover and the generally sparse and scattered oaks. Vertical or linear elements, or elements that contrast in form, line, scale, texture, pattern, or color with their surroundings, tend to be strong points of visual focus and attention in the landscape. Through much of the year, the watershed's annual grasslands are light green or yellow, providing a strongly contrasting background for darker-colored natural and structural elements.

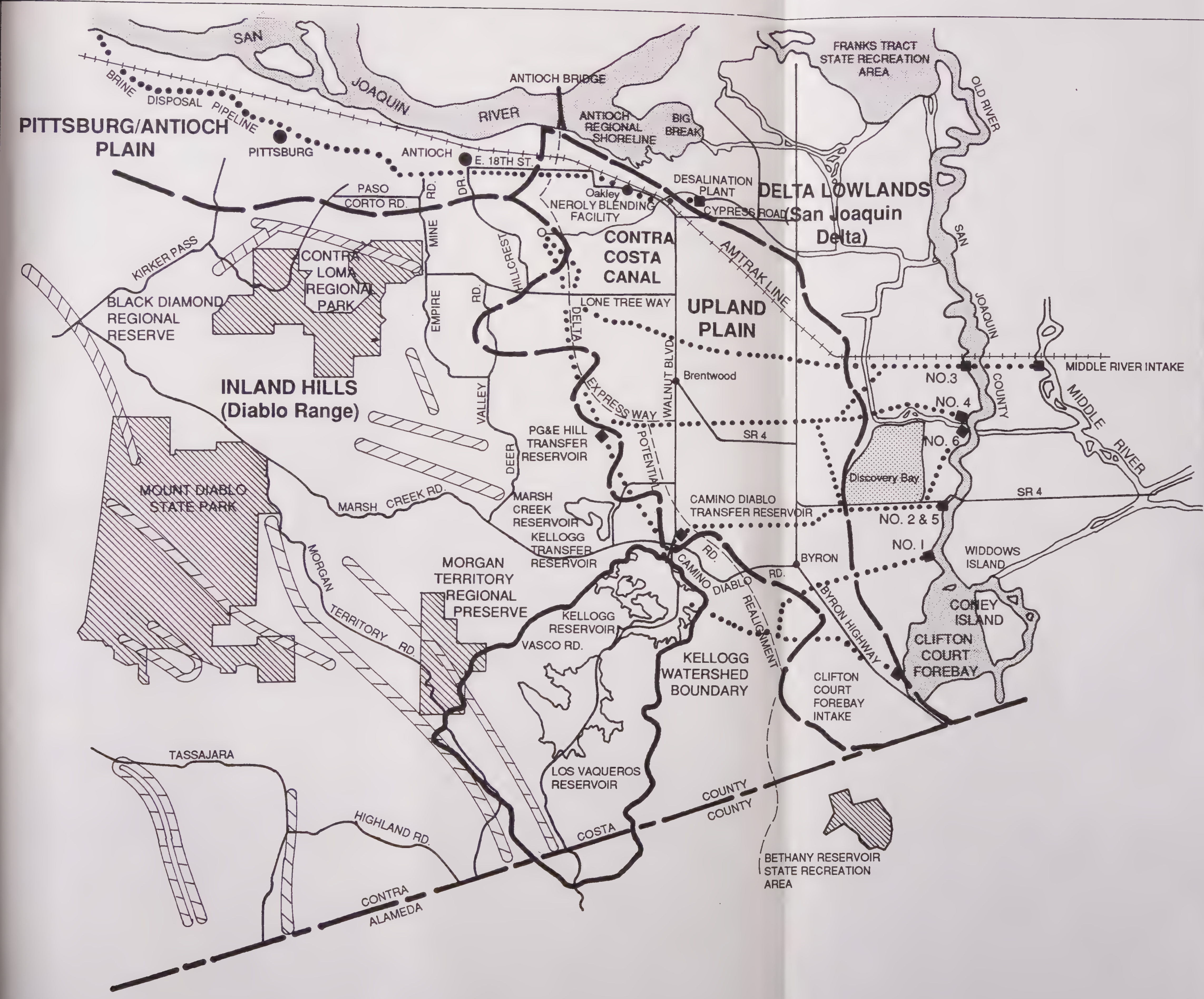


Figure 9-1.
Regional Visual Resources - Landscape Character Zones and Scenic Elements

Legend
- Scenic Routes
- Future Scenic Routes
- Scenic Ridges
- Scenic Waterways
- Visual Character Zone General Boundary
- Pipeline Alignments

Visibility is also a function of access (i.e., how much of an area can be seen, by whom, for how long, how often, and from what locations and directions). Although, the area has very limited public access, Vasco Road is heavily used, mostly by weekday commuters. However, these commuters travel Vasco Road at high speeds, so viewing times are short and the viewers' field of vision is relatively narrow. Though the number of viewing opportunities from Vasco Road is high, views are probably of moderate importance for regular commuters. Several scattered residences, mostly clustered along Morgan Territory Road, have expansive views of the watershed. Though few residents live in the area, their views of the watershed are probably highly important to them. Views from EBRPD's Morgan Territory Regional Preserve at the western edge of the watershed also are important to users of the preserve because views from this area are panoramic and of high quality.

Visual Absorption Capability

The general openness and dominant light-colored, fine-textured grasslands contribute to the watershed's high degree of visibility and low visual absorption capability.

Alternate Intake Facility Site Evaluation

Table 9-1 presents a qualitative assessment of the visual quality of the alternative intake sites.

Visual Resources

The alternate intake structure sites are located within the Delta lowlands visual character zone along the Old River, Middle River, and Clifton Court Forebay (Figure 9-1). Old River and Clifton Court Forebay are designated as scenic waterways by the county (Contra Costa County Community Development Department 1991). The general plan states that projects proposed along scenic waterways should be given careful consideration to assess visual impacts. Because of its openness; pastoral, agricultural character; and scenic designation, the Delta lowlands character zone has high scenic value.

Because of levees and reclamation drainage projects, much of the natural vegetation has been replaced with agricultural uses. Dominant structural elements in the area include some electric transmission lines, pump and irrigation facilities, roads, railroads, and some buildings. Levees, canals, drainage ditches, row crops, wind breaks, orchards, and straight roads and fences produce a rectilinear, rigid, and organized landscape character. The Discovery Bay planned development, south of Indian Slough, is a unique visual element that is different in pattern, scale, form, texture, colors, and character from the surrounding landscape.

Landscape Intactness

Areas surrounding alternate intake sites are generally considered highly intact. The character of these areas is primarily agricultural with adjacent scenic and recreational waterways. The Discovery Bay development, some lattice tower electric transmission lines, and several large structures, however, detract from the intactness. Generally, these elements are not near the alternate intake sites, except the Clifton Court Forebay site.

Visibility

Views from the alternate intake sites are primarily of Old River to the east and flat, agricultural land to the west. Views of the intake sites are from Old River and agricultural access roads. Some views may also be afforded from SR 4 and Byron Highway.

Because of the flat and open landscape, elements are highly visible from surrounding areas. Levees partially screen some views from watercourses but support elevated roads that allow expansive viewing of the area.

Because the Discovery Bay development is a water-oriented living environment, residents often enter and leave by way of scenic waterways. Recreationists' and Discovery Bay residents' views are important, especially from scenic waterways and scenic routes.

Visual Absorption Capability

The landscape of the Delta lowlands character zone is open. Because of the flat topography, generally low-growing row crops, and opportunities to view the surrounding area from waterways and routes located on top of raised levees, visibility is high and visual absorption capability is low.

Alternate Pipeline, Electric Transmission Line, and Transfer Reservoir Site Evaluation

Table 9-1 presents a qualitative evaluation of the alternate pipeline and transfer reservoir sites.

Visual Resources

The alternate pipeline and electric transmission line alignments are located in the Delta lowlands, upland plain, and inland hills landscape character zones. Major portions of the alignments run through the upland plain character zone. The transfer reservoir sites are located in the inland hills character zone. Electric transmission lines are located mostly within the Delta lowlands character zone.

The topography of the alternate pipeline and electric transmission line alignments includes the Delta lowlands character zone, upland plain character zone, and inland hills character zone.

Surface water is an important element of the Delta lowlands portions of the alignments and is virtually nonexistent in the upland plain and higher-elevation areas of the alignments.

Vegetation patterns vary from narrow riparian strips, small marsh areas, and agricultural crops and orchards in the Delta lowlands character zone, to pastures interspersed with windbreaks and riparian corridors in the upland plain character zone. Grazed grasslands with areas of oak woodlands and riparian corridors occur in the hilly western portions of the southern alignments and at the transfer reservoir sites.

The dominant structural elements are roads and railways, lattice tower electric transmission lines, some pumping stations, and buildings and houses. Land uses consist of some recreational parks and boating areas, mostly in lower portions of the alignments; agricultural row crops, pastures, and orchards throughout most of the areas; residential areas, interspersed mostly in the upland plain character zone; and grazing in the hilly upland areas of the southern alignments. Wind turbines occur in the general vicinity of the Clifton Court Forebay pipeline. Quarry operations occur in the immediate vicinity of the Camino Diablo transfer reservoir site.

Landscape Intactness

For the Kellogg transfer reservoir site, landscape intactness is high because of the rural agricultural structures nearby and the hilly, open grasslands surrounding the site. For the Camino Diablo transfer reservoir site, landscape intactness is moderate because of the adjacent quarry operations. For the PG&E Hill transfer reservoir site, intactness is moderate because of the open grasslands surrounding the site and a nearby pump station.

For all the pipeline and electric transmission line alignments, landscape intactness varies considerably through the different landscape character zones. For the Delta lowlands, landscape intactness is generally high because of the low diversity of elements, mostly low-growing row crops. Discovery Bay and electric transmission lines are major elements disrupting intactness in this zone. For the upland plain zone, the landscape is moderately intact. Agricultural elements predominate with some disruption of intactness because of scattered development and visible electric transmission lines. The landscape of the inland hills is mostly intact in the vicinity of pipeline alignments. Some wind turbines may be visible in the area and reduce intactness. All of the alternate pipeline sites are considered, overall, to exhibit moderate intactness.

Intactness in the area of the Neroly blending facility is moderate. Diverse visual elements, such as the Contra Costa Canal, pumping plants, a railroad, roads, and rural residences, contrast somewhat with each other and the open grasslands and orchards in the area.

Visibility

Visibility is generally high for many portions of the alternate pipeline and electric transmission line alignments and the transfer reservoir sites. Alignments and sites are visible from scenic and other roads, the Amtrak rail line, and rural residences. Two of the transfer reservoir sites are adjacent to and visible from scenic routes.

In the Delta lowlands, visibility is high, especially from the levee roads, because of a general lack of terrain relief and low-growing row crops through much of the area. The visibility of the alignments and sites is not great in the upland plain areas because of more varied topography, vegetation, and crop cover, and an absence of raised levee routes.

The alignments are visible from residential areas; areas where alignments cross or are close to roads, especially scenic routes such as the heavily used SR 4 or Byron Highway; and areas where alignments are visible from the Amtrak rail line.

Visual Absorption Capability

The low diversity of landscape elements contributes to the low capability of the landscape to absorb visual changes that may affect the landscape character. In the Delta lowlands character zone, the landscape is highly visible and has low visual absorption capability because of the flat topography, mostly low-growing row crops, few structures, and opportunities to view the area from raised roads on levees. In the upland plain character zone, visual absorption capability is low to moderate with greater visual diversity provided by more diverse topography; more varied vegetation, especially orchards; and more development and structures. In the inland hills character zone, the landscape's visual absorption capability is moderate because of the more varied topography.

Table 9-1 presents a qualitative evaluation of these project alternative sites.

Visual Resources

The desalination plant site is located within the Delta lowlands character zone adjacent to the upland plain character zone. A brine disposal pipeline would be constructed from the plant to Suisun Bay mostly within the Pittsburg/Antioch plain character zone. An electric transmission line would run from the plant site adjacent to the Contra Costa Canal to an existing electric transmission line west of the Neroly blending facility site. The Neroly blending facility site is located in the inland hills character zone adjacent to the upland plain character zone.

The desalination plant site is located next to the Amtrak rail line and scenic SR 4 and Cypress Road, and within view of several nearby residences. The electric transmission line would pass through mostly residential areas and orchards. The brine disposal pipeline would be constructed through agricultural, residential, and industrial lands and adjacent to portions of the SR 4 and East 18th Street scenic routes. The final reach of the pipeline would pass through visually sensitive marsh land along Suisun Bay. Lands in the immediate vicinity of the blending facility site are flat.

Landscape Intactness

Intactness of the area around the desalination plant is moderate. The area has a rural character comprised mostly of agricultural lands and structures and some trees. Few visually disruptive elements exist in this area. Landscape intactness along the electric transmission line alignment is moderate. A few orchards and open fields contribute to the intactness of the area's somewhat rural suburban character. For the brine disposal pipeline, intactness is moderate to high along scenic routes and in the marsh, and low to moderate in other reaches. Overall, the brine disposal pipeline exhibits low intactness because most of the alignment would be located in commercial and industrial areas.

Visibility

The desalination plant would be located in an area of high visibility from scenic routes SR 4 and Cypress Road. It may also be visible to existing and future residences nearby. The associated electric transmission line would be highly visible from numerous roads and residences in the area. Visibility of the brine disposal pipeline alignment would be high for most of these areas because of the large number of people able to view the area. High visibility would be especially important for the portion of the alignment running along or near scenic routes.

Visual Absorption Capability

The desalination plant would be located in an area of low to moderate visual absorption capability because of the site's flat topography, low-growing vegetation, and general lack of nearby diverse visual elements. Visual absorption capability for most of the electric transmission line alignment is moderate because of the moderate diversity of visual elements such as houses and orchards. For the brine disposal pipeline alignment, visual absorption capability varies greatly. In areas containing a diversity of visual elements, such as buildings and other structures, visual absorption capability is moderate to high. For open, less visually diverse areas, such as the tidal marsh at Stake Point, visual absorption capability is low.

ENVIRONMENTAL CONSEQUENCES

Introduction

This visual resource evaluation identifies significant impacts that would occur under the project alternatives. The discussion of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives identifies significant impacts on viewers during facility construction and impacts on viewers and Kellogg Creek watershed recreation users after project facilities are completed. This evaluation also identifies the potential visual impacts of developing watershed recreation facilities and recommends development guidelines where appropriate to reduce visual conflicts.

The analysis of the other project alternatives also identifies significant impacts on viewers during and after construction activities.

Visual impacts of the project alternatives could result if changes were made to the character and quality of the environment as viewed by users. Visual resource elements of high visual quality and sensitivity generally are those that are visible to many people, highly intact, and have low visual absorption capabilities. For this analysis, the screening criteria described below were applied to determine the significance of impacts. Only those impacts that were found to be significant are described in detail below.

Methodology and Criteria for Conclusions of Significance

Visual resource impacts are described for each important component of the alternatives. Visual resource sensitivity is assessed using ratings of visual quality (Table 9-1) and ratings of visibility and visual absorption capability. Impacts on sensitive visual resources are considered significant.

Visual resource impacts are determined by judging what likely effects development of a project alternative would have on views and potential users. These judgments are based on the visual quality of the site (Table 9-1), possible viewer expectations, and the positions and distance of viewers from project facilities. The relative visibility of a site is also assessed based on an estimate of the possible number of users viewing the site and the duration and frequency of the views.

Generally, visual resource impacts are considered significant if a project alternative would result in:

- changes in views with moderate-to-high visual sensitivity or
- visually incongruous facilities in areas exhibiting moderate-to-high visual sensitivity.

No-Action Alternative

If none of the project alternatives were implemented, improvements to the Contra Costa Canal would be required to meet increased future CCWD demands. However, because the resulting impacts would be temporary construction-related impacts, and because these improvements would not substantially change the current visual resources and would be contained within the established right-of-way, no significant impacts would result.

Los Vaqueros Reservoir Alternative

The evaluation of this alternative focuses on project components that would be sited aboveground. Visual impacts of the water conveyance pipelines would occur only during the construction period because all pipelines would be underground. Because construction impacts of pipelines are temporary and pipelines would not be visible after construction, their visual influence is small and impacts are considered less than significant. No mitigation is required for any of the pipelines and no further evaluation is presented.

Impacts of the Dam and Reservoir

Reservoir

During construction, views of the watershed would be scarce because of the closure of the existing Vasco Road. Because construction activities would affect few people visually and because impacts would be temporary, this impact would be less than significant.

Implementation of this alternative would substantially change the Kellogg Creek watershed's visual character. The 1,500-acre reservoir would visually dominate the landscape's scale and character. Because water is not an important element of the existing landscape, its introduction would reduce the landscape's visual intactness. This landscape change would not likely be visually intrusive for most viewers, however, because views would be distant and water features are often considered positive landscape visual features. This impact would be less than significant.

Fluctuations in the reservoir water level would create a continuous light-colored ring around the water edge. Visual impacts on recreation user views from exposing large areas of bare ground in the shallow arms of the reservoir would be severe because this exposed ground would contrast with the surrounding vegetated landscape and reduce visual intactness. During drawdown, the surface level of the reservoir would fluctuate vertically 5-7 feet below maximum pool during normal rainfall years and 50-60 feet during dry years. The exposed ring around the perimeter of the reservoir would create a significant unavoidable visual impact on recreation users. No mitigation is available to reduce this impact to a less than significant level.

Views of the pastoral and natural aesthetic character of the existing valley from the inundated portion of Vasco Road would be lost. These lost views along Vasco Road would be replaced by similar views along the County Line Alignment. Therefore, the loss of views would be a less-than-significant impact. No mitigation is required.

Dam and Spillway

Visual impacts during construction would be less than significant because, as described above under "Reservoir", few views of the construction site would be available. This impact would be less than significant. No mitigation is required.

Constructing the 192-foot-high earthen dam within the Kellogg Creek watershed would substantially change the visual character and quality of the landscape. The dam's massive, engineered form and straight lines would contrast strongly with the surrounding rolling hills and undulating ridge lines. The light-colored concrete spillway and riprap-lined stilling basins would contrast in form, line, color, and texture with the surrounding landscape. The dam and spillway facilities would not be easily visually absorbed in the landscape and would substantially affect the area's landscape intactness.

Although large artificial structures can be considered visually interesting when designed to fit the surrounding environment, dam structures in particular can be visually disruptive, detracting from the natural

landscape. Adverse visual impacts of views of the dam from the reservoir would be significant and unavoidable because the visible portion of the dam face would be covered with riprap and the dam contour and reservoir water level would create a distinct break in the natural ridge line, which could not be buffered.

Views of the massive earthen dam and concrete spillway from downstream locations could also create visual impacts on watershed recreation users. The dam face would strongly contrast in form, line, color, and texture with the surrounding landscape, thus reducing landscape intactness. Because the visual sensitivity of the dam site would be high, this impact would be significant. To reduce this impact to a less-than-significant level, native trees, bushes, shrubs, and ground cover could be established at the base of the dam and on hillsides near the dam as long as dam safety and access are not compromised.

Ridge Quarry. The ridge quarry site, located on the ridge west of the dam and spillway, would be visible to watershed recreation users. From the north, the ridge would be highly visible from the Vasco Road approach to the reservoir; from the south, it would be visible from the edge of the reservoir. A portion of the ridge would be excavated, exposing lighter-colored underlying material that would contrast with surrounding vegetation and soil colors.

Ridge lines are prominent and sensitive visual elements. Altering the ridge line by removing material would create a disruptive visual contrast in the natural landscape. Building a haul road up the north side of the ridge would create a substantial scar in the landscape that would contrast with the surrounding, more natural landscape. The visual impacts of the ridge quarry are considered significant. To reduce these impacts to less-than-significant levels, the quarry and road could be sited and designed according to a detailed reclamation plan that provides measures for minimizing the quarry and road visibility from recreation users to the north and south.

Impacts of Recreation Facilities

In general, the impacts on visual resources of implementing the conceptual recreation plan were found to be less than significant. The facilities would be constructed to serve recreation demand that would not exist without the implementation of the alternative, and, as additional recreation planning progresses, CCWD will incorporate appropriate design parameters into its recreation facility design process as suggested in the conceptual recreation plan.

If designed correctly, the recreation area could be a visually appealing amenity for recreation users. For continued recreation planning and design of the Kellogg Creek recreation and staging areas, the following design guidelines are suggested:

- locate recreation structures in the least visually sensitive areas of the northern watershed valley;
- minimize removal and disturbance of native and other important vegetation;
- locate and design roads, parking areas, and structures to minimize disruption of the visual intactness and views of surrounding natural areas;
- use building forms, materials, and colors that blend with natural landscape elements of the area (e.g., buildings and structures of low height, wood and natural stone exterior, and primarily earth-tone colors);
- screen and buffer structures and parking areas from trails and the entry road with native vegetation and landscape berms;
- locate the 120-unit campground in an area that is or will be fully screened from views from other recreation facilities, roads, and trails; and

- locate and design the equestrian facilities in a manner that partially or fully screens them from the primary access road.

For continuing recreation planning and design of the reservoir use area facilities, the following guidelines are suggested:

- locate structural facilities, where possible, away from the shoreline and valley bottoms, and below ridge lines;

- minimize removal and disturbance of native and other important vegetation;

- revegetate all graded or disturbed areas with native ground cover and trees;

- locate and design roads, trails, and structures to minimize adverse impacts on highly intact landscape features and high quality views of surrounding natural areas;

- use structural forms, materials, and colors that blend well with natural landscape elements of the area (e.g., buildings and structures should be of low height, wood and natural-stone exterior, and primarily earth-tone colors);

- screen the shuttle route along the northwest dam abutment and on the peninsula with native trees, shrubs, bushes, or landscape berms, as appropriate; and

- locate and design fishing piers, marinas, and other water-dependent facilities in the least visually sensitive locations, where possible; construct these facilities with materials that fit the existing rural character in form, line, and color.

The remaining recreation facilities that would be constructed in the watershed would be primarily low-intensity, dispersed facilities such as hiking and horseback riding trails. In many cases, these trails would be naturally screened by the landscape and vegetation and some would afford recreation users panoramic views of the watershed. Because many of these facilities would have visually beneficial effects and would not substantially alter the landscape character or visual intactness of other watershed features, no significant impacts would occur. However, the following trail design guidelines are suggested for inclusion as part of continuing recreation planning and design:

- avoid grading or cutting and filling in areas with highly intact landscapes that are visible from other recreation use areas; in general, trails should be sited in the least visually sensitive areas possible; highly sensitive areas include steep and visible hillsides and ridgetops;

- avoid or minimize removal and disturbance of vegetation, to the greatest extent possible; oak woodlands and chaparral vegetation are particularly visually important;

- revegetate all graded or disturbed areas along trails to achieve a natural appearance;

- use trail materials and colors that compliment or blend well with natural landscape elements near trail sites; and

- screen highly visible trails that create visual scars in areas with high quality views.

Impacts Associated with Intake, Transfer, and Electric Transmission Facilities

Rock Slough/Old River No. 1 Configuration

Intake Facility. This intake facility would be located at a bend of Old River that is adjacent to agricultural land on the west and is not easily visible from public or scenic roads. The intake facility would be highly visible, however, to boaters on Old River. This large structure would be in the foreground distance zone for most viewers on the river and would be above the river elevation near the levee. Because Old River is designated as a scenic waterway and the intake facility would be highly visible from the river, and would not be easily absorbed into the natural landscape, the visual impacts of this facility on viewers along Old River are considered significant. To reduce this visual impact to a less-than-significant level, the structure could be screened using trees, shrubs, and landscape berms and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

Kellogg Transfer Reservoir. The 10-acre reinforced concrete transfer reservoir and the pumping plant would be located in an important visual area near the northern portion of the existing Vasco Road. Vasco Road would serve as a major public entry to the reservoir's proposed recreation area. Located near the proposed equestrian center and a major recreation and staging area, the site has high visual sensitivity. The aboveground features, including the pumping plant, electric substation, short connection to the nearby existing electric transmission line, and fencing would be new artificial landscape features that would reduce the landscape intactness of this visually sensitive area. Visual impacts of the pumping plant and other aboveground facilities are considered significant. To reduce this impact to a less-than-significant level, the site should be visually screened from recreation use areas and structures should be constructed with earth-tone building materials.

Electric Transmission Line. The electric transmission line would be located along the pipeline alignment from the intake facility to an existing north-south power line. The line would be supported on large metal towers that would contrast with the flat, agricultural lands of the area where it is visible in foreground and middle ground distance zones. Visibility of much of the electric transmission line would be relatively low, except near the intake structure where it could be viewed from Old River. Visual impacts of the electric transmission line would be significant and unavoidable where the line could be viewed from Old River, a designated scenic waterway. No mitigation is available to reduce this impact to a less-than-significant level.

Rock Slough/Old River No. 2 Configuration

Intake Facility. The Old River No. 2 intake facility would be highly visible from both SR 4, a scenic highway, and Old River. The visual appearance of this intake would be similar to that described above for the Old River No. 1 intake facility, but would be visible to more people along SR 4 and Old River. Use of this alternate intake site would significantly affect the site's visual resources. To reduce this visual impact to a less-than-significant level, the structure should be screened using trees, shrubs and landscape berms, and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

PG&E Hill Transfer Reservoir. This 10-acre reinforced concrete transfer reservoir and the pumping plant would be similar to the Kellogg transfer reservoir described above. Visual quality in this area is generally low, as is the site visibility. Therefore, the visual sensitivity of this site is low and visual impacts of this facility would be less than significant. No mitigation is required.

Electric Transmission Line. The new electric transmission line would parallel SR 4 and its eastern portion near the intake facility would be visible from Old River. The new electric transmission line towers would be visually intrusive and would detract from the rural, open-space landscape. Therefore, this facility would result in a significant visual impact. No mitigation is available to reduce this impact to a less-than-significant level.

Rock Slough/Old River No. 3 Configuration

Intake Facility. The Old River No. 3 intake facility would be similar to the intake facility identified for the Rock Slough/Old River No. 1 configuration. Because this structure would be visible from Old River and would be visually imposing for recreationists along Old River, and because the site is considered moderately sensitive visually, this impact would be significant. To reduce this visual impact to a less-than-significant level, the structure should be screened using trees, shrubs, and landscape berms, and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

PG&E Hill Transfer Reservoir. Impacts under this alternate configuration would be identical to the impact identified for the Rock Slough/Old River No. 2 configuration.

Electric Transmission Line. The new electric transmission line would be visible from Old River. Although a major transmission line corridor is located nearby along Byron Highway, the new transmission line towers would be visually intrusive and would detract from the rural, open-space landscape. Therefore, this facility would result in a significant unavoidable visual impact. No mitigation is available to reduce this impact to a less-than-significant level.

Rock Slough/Old River No. 4 Configuration

Intake Facility. The Old River No. 4 intake facility would be similar to the intake facility identified for the Rock Slough/Old River No. 1 configuration. As with the other intake facilities, this imposing structure would be visible from Old River and possibly from the Discovery Bay development. Because the intake site is rated moderately sensitive visually, this impact would be significant. To reduce this visual impact to a less-than-significant level, the structure should be screened using trees, shrubs, and landscape berms, and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

PG&E Hill Transfer Reservoir. The transfer reservoir visual impact under this alternate configuration would be identical to the impact identified for the Rock Slough/Old River No. 2 configuration.

Electric Transmission Line. The new electric transmission line could be visible from the Discovery Bay development and from Old River. Although a major electric transmission line corridor is located nearby along Byron Highway, the new transmission line towers would be visually intrusive and would detract from the rural, open-space landscape. Therefore, this facility would result in a significant unavoidable visual impact. No mitigation is available to reduce this impact to a less-than-significant level.

Rock Slough/Old River No. 5 Configuration

Intake Facility. This intake facility would be identical to the intake facility described for the Rock Slough/Old River No. 2 configuration. Visual impacts of this facility would be significant. To reduce this visual impact to a less-than-significant level, the structure should be screened to the extent feasible using trees, shrubs and landscape berms, and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

Camino Diablo Transfer Reservoir. This 10-acre transfer reservoir, pumping plant, and associated new 1-mile-long electric transmission line would be located in a relatively sensitive visual area within 0.25 mile of the intersection of two scenic routes (Camino Diablo Road/Vasco Road intersection). However, this area exhibits only moderate visual quality and is not highly visible or sensitive. Sand quarry operations southwest of the transfer reservoir currently detract visually from this relatively flat landscape. Because this site would have only low visual sensitivity, the impacts of the reservoir structure would be less than significant. No mitigation is required.

Electric Transmission Line. Visual impacts of the electric transmission line would be identical to those described above for the Rock Slough/Old River No. 2 configuration. Visual impacts would be significant for the entire length of the alignment and no mitigation is available to reduce these impacts to less-than-significant levels.

Rock Slough/Old River No. 6 Configuration

Intake Facility. The Old River No. 6 intake facility would be similar to the intake facility identified for the Rock Slough/Old River No. 1 configuration. As with the Old River No. 1 intake facility, this structure would be visible from Old River and possibly from the Discovery Bay development. Because the intake site is rated moderately sensitive visually, this impact would be significant. To reduce this visual impact to a less-than-significant level, the structure should be screened using trees, shrubs, and landscape berms, and should be designed to complement the natural landscape in form, line, and color, to the extent possible.

Camino Diablo Transfer Reservoir. The transfer reservoir visual impact under this alternate configuration would be identical to the impact identified for the Rock Slough/Old River No. 5 configuration.

Electric Transmission Line. The visually imposing electric transmission line towers would be visible from SR 4, the Discovery Bay development and Old River. Visual impacts would be significant for the portions of the transmission line near the intake structure, at the SR 4 crossing, and parallel to SR 4, because these areas are within the foreground distance zone of scenic routes or waterways. No mitigation is available to reduce these visual impacts to less-than-significant levels.

Rock Slough/Clifton Court Forebay Configuration

Intake Facility. The Clifton Court Forebay intake facility would be similar in design to the intake facility described above for the Rock Slough/Old River No. 1 configuration, with the addition of a 1,400-foot canal connecting the facilities to the California Aqueduct intake channel. Though visible from the scenic Byron Highway and Clifton Court Forebay, the current intake site is not highly intact because the landscape contains several visually intrusive structural elements. Because the visual sensitivity of this area is low, this impact is less than significant. No mitigation is required.

Kellogg Transfer Reservoir. Impacts and mitigation measures would be identical to those described above under "Rock Slough/Old River No. 1 Configuration".

Electric Transmission Line. Because electric transmission lines currently run through the site, no major new lines will need to be constructed; therefore, no visual impacts associated with new electric transmission lines would occur under this alternate configuration. No mitigation is required.

Impacts of Vasco Road and Utility Relocations

Visual resource analyses were conducted as a part of the Vasco Road and Utilities Relocation Project EIR certified by CCWD in September 1990. Although a number of significant visual resource impacts were identified for the relocation of the electric transmission lines, natural gas pipelines, and petroleum pipelines, CCWD adopted mitigation measures to reduce impacts to less-than-significant levels. For detailed information regarding these impacts and mitigation measures, refer to the Vasco Road and Utility Relocation Project EIR.

Kellogg Reservoir Alternative

Visual impacts associated with the intake facilities, transfer reservoir, blending facility, pertinent recreation features, and most water conveyance facilities would be identical to those of the Los Vaqueros Reservoir Alternative and are discussed above. Significant visual impacts of the other elements of this alternative are described below.

Impacts of Dam and Reservoir Construction and Operation

Reservoir. Although the Kellogg Reservoir would be located several miles north of the Los Vaqueros Reservoir, the visual setting of the two sites is similar and impacts would therefore be identical.

Dam and Spillway. Impacts of the Kellogg dam would be essentially identical to those described for the Los Vaqueros Reservoir and dam.

Saddle Dam Impacts. Of the nine saddle dams, the six northern-most dams would be located within view of the scenic Camino Diablo Road in the foreground and middle ground distance zones. The engineered forms and straight lines of the saddle dams would contrast with the surrounding rolling hills and undulating ridge lines. The saddle dams would not be easily absorbed visually into the landscape and could reduce the overall visual intactness of the watershed. Visual impacts of the six northern-most dams would therefore be significant. To reduce these impacts to less-than-significant levels, measures similar to those described above for the Kellogg dam should be implemented.

Impacts of Recreation Facilities

Because the intensity, type, and amount of recreation described for the Los Vaqueros Reservoir Alternative would also apply to the Kellogg Reservoir Alternative, visual impacts of recreation facility development would be similar to those described for the Los Vaqueros Reservoir Alternative. Recreation facility development around the Kellogg Reservoir could result in substantial change to the watershed is visual character and intactness. If designed correctly, however, the recreation area could be a visually appealing amenity for recreation users. Therefore, these impacts would be less than significant. The same design guidelines suggested for the Los Vaqueros Reservoir Alternative could be implemented as part of continuing recreation planning and design of the watershed.

Desalination/EBMUD Emergency Supply Alternative

Impacts of Intake Channel Improvements

Visual impacts of widening the existing 4-mile-long intake channel by 23 feet would not be significant for most of the channel's length. Doubling the channel's width would not create significant changes in form, line, or other visual characteristics, although it would increase the scale. The channel is not generally visible to many people. Visual impacts would therefore be considered less than significant.

Impacts of Desalination Plant Construction and Operation

Although the visual quality of the desalination plant site is considered relatively low, the plant would be moderately visible from Cypress Road and would not easily blend with the surrounding landscape. The site is therefore considered moderately sensitive to visual changes. Most desalination plant structures would

be concrete linear forms and would contrast with the existing visual resources. Although the height of most structures will be low, several structures, such as the clear well and desalination building, will be more than 20 feet tall and will produce noticeable changes in the existing landscape's form, line, color, and texture. This change would be a significant impact. To reduce this impact to a less-than-significant level, the plant should be visually screened from sensitive receptors with trees, shrubs, and landscape berms.

Impacts of Electric Transmission Line

The electric transmission line between the desalination plant and the existing electric transmission line near the Neroly blending facility would be highly visible along its entire length. The line would affect the intactness of the area viewshed and would introduce new forms that contrast with the existing visual elements of the residential and agricultural areas. This change in the visual landscape would be a significant and unavoidable impact. This impact could not be mitigated to a less-than-significant level.

Middle River Intake/EBMUD Emergency Supply Alternative

Impacts of Intake and Pumping Plant Construction and Operation

Design of the Middle River intake and pumping plant facilities would be similar to that of the Old River No. 1 intake facility under the Los Vaqueros Reservoir Alternative. The intake would be located on Middle River in San Joaquin County in an area farmed in row crops and south of the Amtrak line. The intake would be within the foreground distance zone and visible from both directions to viewers traveling along the waterway and the rail line. The low height of the intake structure would not affect the area's visual intactness. The impact would be less than significant. No mitigation is required.

The large pumping plant structure would be located on the same site as the Rock Slough/Old River No. 3 facility on Old River within the foreground distance zone and highly visible from both directions to viewers traveling along the scenic waterway and moderately visible from Middle River and the Amtrak railroad line. This site is therefore considered moderately sensitive. The substantial alteration in the landscape viewshed would be a significant impact. To reduce this impact to a less-than-significant level, the pumping plant structure should be screened using trees, shrubs, and landscape berms and should be designed to complement the natural landscape in form, line, and color to the extent possible.

Electric Transmission Line

The electric transmission line that would serve the pumping plant would follow the pipeline alignment from the intake at Middle River to the Werner-Dredger Cut. At the cut, the alignment turns southwest to the existing north-south power line. The line would contrast strongly with the flat agricultural lands of the area and affect the intactness of the viewshed along the entire length of the line. It would be visible in the foreground distance zone to viewers from the Amtrak rail line, from the scenic river near the pumping plant, and from Middle River near the intake. The visual impact of the transmission line would be significant and unavoidable. No mitigation is available to reduce this impact to a less-than-significant level.

MITIGATION MEASURES

No-Action Alternative

No mitigation is required.

Impacts of Dam and Reservoir Construction and Operation

Reservoir. No mitigation is available to reduce impacts to a less-than-significant level.

Dam and Spillway Impacts

9-1: Screen Dam Edges with Native Vegetation. CCWD could establish native trees, shrubs, and ground covers near the base of the dam and on hillsides along the dam edges, as long as dam safety and access are not compromising, to help soften the visual effects of the dam structure's straight lines and massive scale. Native trees and plants could be used to screen portions of the spillway and dam from Vasco Road, trails, and recreation facilities in the reservoir use area and Kellogg Creek recreation and staging area. Wildflowers and grasses that would not interfere with maintaining, inspecting, and operating the dam could also be established and maintained on the downstream face of the dam. Planting patterns should replicate natural vegetation patterns on surrounding hillsides. Full implementation of this measure may not be feasible, however, because trees and shrubs may interfere with dam safety inspections.

Ridge Quarry Site Impacts

9-2: Implement a Detailed Quarry Reclamation Plan. CCWD should implement a quarry reclamation plan to mitigate the ridge quarry visual impacts. Elements of the plan should include:

- locating the quarry and designing its configuration to minimize its visibility from entry roads and trails and important recreation use areas;
- minimizing removal and disturbance of vegetation, particularly oak trees;
- preventing erosion and resulting scars that would have long-term visual effects;
- partially filling and recontouring the excavated area and adjacent lands to blend with adjacent landforms;
- revegetating all disturbed areas to achieve essentially a natural appearance and a self-sustaining vegetation regime for the area within a 5-year period; and
- implementing a 5-year vegetation monitoring and replacement program for all disturbed lands, including the access haul road and any equipment storage areas.

Impacts Associated with Water Conveyance Facilities

Mitigation measures identified below apply to alternate intake and transfer reservoir facilities under Rock Slough/Old River No. 1-6 configurations. The Clifton Court Forebay intake facility would not require mitigation.

Intake Facilities

9-3: Visually Screen Intake Facilities from Sensitive Receptors. CCWD could reduce the visual impact of intake facilities to a less-than-significant level by establishing native trees, shrubs, and ground covers as aesthetic treatment and partial visual screening between important viewing areas and intake facilities. Plants or landscape screens also would be needed for Old River No. 2 and No. 5 intake facilities because they are located adjacent to the scenic route portion of SR 4 and would be highly visible

from Old River. Visual impacts of the intake facilities could also be reduced by limiting structure heights, using earth-tone colors on structure to blend with the surrounding landscape, emphasizing horizontal features in the building design, and using earth berms near structures both as partial screening and to better connect the building to the site and area.

Transfer Reservoirs

9-4: Visually Screen the Kellogg Transfer Reservoir from Recreation Uses. To reduce visual impacts to less-than-significant levels, CCWD should screen the Kellogg transfer reservoir from the northern portion of Vasco Road that would serve as the primary access to watershed recreation areas and from use areas in the Kellogg Creek recreation and staging area using native trees, shrubs, and ground cover and landscaped berms or wooden fences. The pumping facility structures could also be painted in earth tones to compliment the surrounding landscapes.

Electric Transmission Lines. No mitigation is available to reduce impacts to less-than-significant levels.

Kellogg Reservoir Alternative

Impacts of Dam and Reservoir Construction and Operation

Reservoir. No mitigation is available to reduce impacts to less-than-significant levels.

Dam and Spillway Impacts

Screen Dam Edges with Native Vegetation. CCWD could implement measure 9-1 to reduce this impact to a less-than-significant level.

Impacts of Intake Facility Construction and Operation

Visually Screen Intake Facilities from Sensitive Receptors. CCWD could implement measure 9-3 to reduce impacts to less-than-significant levels.

Saddle Dam Impacts

9-5: Visually Screen and Buffer the Six Saddle Dams Visible from Camino Diablo Road. CCWD should visually screen and buffer the visual effects of six of Kellogg Reservoir's saddle dams. Screening could be accomplished using native trees, shrubs, and ground cover at the base and along the vertical edges of the dam to soften the ridged features of the dam face and blend naturally into the landscape. Low-growing native shrubs, forbs, wildflowers, and grasses that would not interfere with maintaining, inspecting, and operating the dams, could also be established and maintained on the downstream faces of dams. Patterns of plantings should replicate natural vegetation patterns of the surrounding landscape.

Desalination/EBMUD Emergency Supply Alternative

Impacts of Desalination Plant Construction and Operation

9-6: Visually Screen the Plant from Sensitive Receptors. CCWD should visually screen the plant facilities from Cypress Road, SR 4, and existing and future residences and parks. Screening could be accomplished by using earth-tone colors for visible facilities and establishing native trees, shrubs, and ground covers. Landscaped berms and fences may also be used in combination with plantings to help screen the plant from sensitive visual receptors.

Electric Transmission Line

No mitigation is available to reduce impacts to less-than-significant levels.

Middle River Intake with EBMUD Emergency Supply Alternative

Impacts of Intake and Pumping Plant Construction and Operation

Visually Screen Intake Facilities from Sensitive Receptors. CCWD could implement measure 9-3 to reduce impacts to less-than-significant levels.

Electric Transmission Lines

No mitigation is available to reduce impacts to less-than-significant levels.

Chapter 10. Geology, Seismicity, and Soils

AFFECTED ENVIRONMENT

This section describes the geologic, seismic, and soil conditions of the project area. Information from several reconnaissance-level geologic and engineering studies prepared for the Los Vaqueros Project have been used in this analysis: Los Vaqueros Offstream Storage Unit, Engineering Feasibility (California Department of Water Resources 1981); Damsite Investigations Report (Woodward-Clyde Consultants 1988); and Conveyance and Pumping Facilities Concept Report (James M. Montgomery, Consulting Engineers 1989a). In addition, the geology of the project area has been mapped by USGS and the California Division of Mines and Geology (CDMG). Soils have been mapped by SCS and important farmlands have been mapped by the California Department of Conservation (CDC).

The current geologic, seismic, and soil conditions are discussed regionally and for specific areas that would accommodate project alternatives.

Regional Geology

Contra Costa County is in west-central California, southeast of San Pablo Bay and south of Suisun Bay. The north-central part of the county borders the confluence of the Sacramento and San Joaquin Rivers. The eastern part of the county, within the San Joaquin Valley and the Delta, is nearly level. The central part of the county ranges from nearly level land to sloping valleys. The rest of the county consists of steep to very steep uplands. Mt. Diablo, at an elevation of 3,849 feet, is the county's dominant landmark.

Contra Costa County is located predominantly within the Coast Ranges geologic province. The eastern part of the county is in Sierran Block geologic province (Figure 10-1).

The Coast Ranges province consists of complexly folded and faulted Tertiary marine and nonmarine formations and Cretaceous marine formations (AGS 1989). Recent surface deposits have originated from alluvial fans, streams, and landslides.

The eastern part of the county is in the Great Valley portion of the Sierran Block province. This area consists of deep alluvial materials underlain by basement rock of the Sierran Block province.

Regional Seismicity

Contra Costa County is in a seismically active region. Regional seismicity is dominated by the San Andreas, Hayward, and Calaveras faults (AGS 1989). Several earthquakes with Richter magnitudes of 5 or greater have occurred in the region. The most notable events have occurred on the San Andreas fault, including the 1906 San Francisco earthquake, with a Richter magnitude of greater than 8, and the 1989 Loma Prieta earthquake, with a Richter magnitude of 7.0. Other notable events are the 1836 and 1868 earthquakes on the Hayward fault (approximate magnitude 7), the 1861 earthquake near Dublin, possibly on the Calaveras fault (estimated at magnitude 6), and the 1892 Vacaville-Winters earthquakes (estimated magnitude greater than 6.5) on the Coast Range-Sierran Block boundary zone. Figure 10-2 identifies the

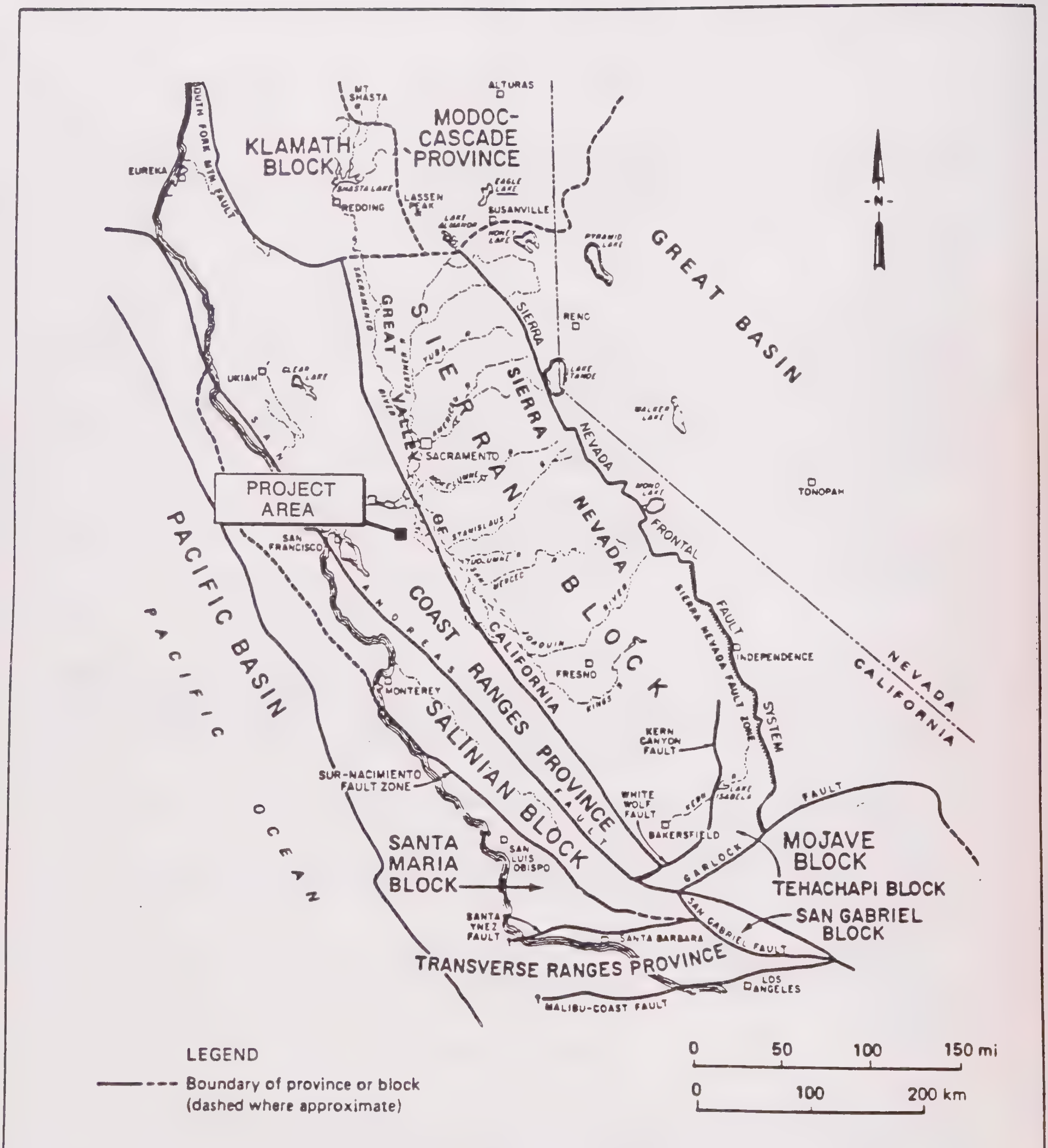


Figure 10-1. Geologic Provinces of Central California

Source: Woodward-Clyde Consultants 1988

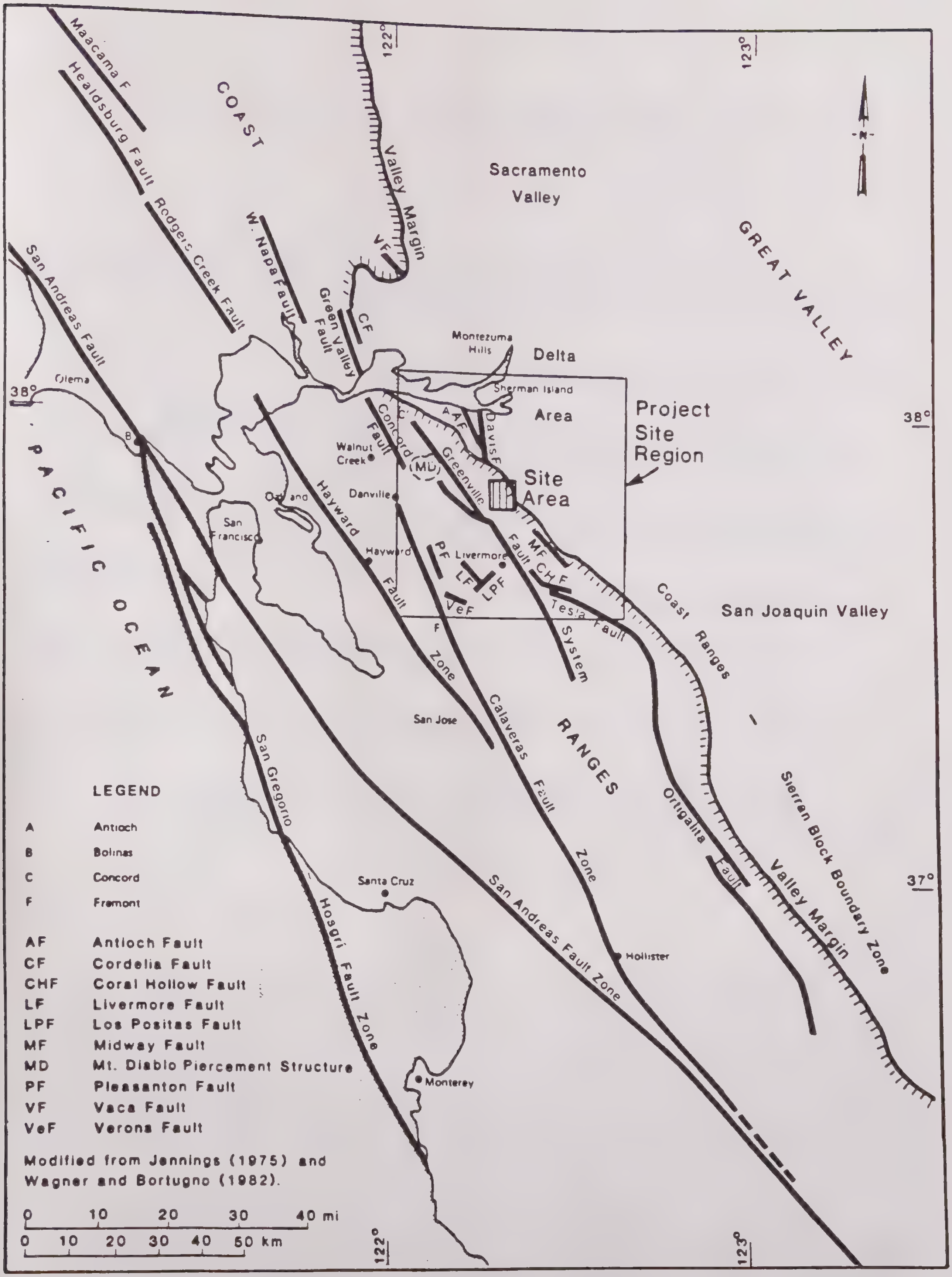


Figure 10-2. Significant Quaternary Faults of the San Francisco Bay Region

Source: Woodward-Clyde Consultants 1988

major faults in the project vicinity. Table 10-1 identifies the faults most likely to affect the project vicinity and the maximum credible earthquakes (MCE) for each fault.

Regional Soil Conditions

The geologic and soil information contained in the general soil map (Figure 10-3) and the important farmland map (Figure 10-4) is adequate to predict impacts on soils. Therefore, the discussion of soil resources focuses on general soil properties and subsurface conditions.

Fourteen soil associations have been identified in the Contra Costa County soil survey (Figure 10-3). These associations can be grouped into three broad categories:

- nearly level to strongly sloping soils on valley fill, basins, low terraces, and alluvial fans;
- nearly level, poorly drained soils on the Delta, saltwater marshes, and tidal flats; and
- steep, well-drained soils on terraces and mountainous uplands.

Important farmlands are found predominantly in the eastern portion of the county near the Delta. These important farmlands are divided into the following four categories by the CDC (1984):

- prime farmland is land that has the best combination of physical and chemical characteristics for the production of crops;

- farmland of statewide importance is land other than prime farmland that has a good combination of physical and chemical characteristics for the production of crops;

- unique farmland is land that does not meet the criteria for the previous farmlands and that is used for production of specific high economic value crops; and

- farmland of local importance is land that does not meet the criteria for the previous farmlands but that is currently producing crops and may be important to the local economy.

Kellogg Creek Watershed and Vicinity

Geology

The Kellogg Creek watershed is a combination of flat, hilly, and mountainous terrain. Most of the upland areas are underlain by upper Cretaceous marine sedimentary rocks of the Panoche formation (65 million years old). These rocks are characterized by massive, cavernous weathering of surface materials and consist of concretionary sandstone, shale, siltstone, and conglomerate lenses. Other geologic formations (Meganos, Moreno, and Deer Creek) are also present and have properties similar to those of the Panoche formation. In most areas, bedrock is encountered at depths of 25 feet or less. Rock outcrops are commonly found on ridges and hilltops. This outcrop pattern is common in the Coast Ranges province. The area bedrock ranges from soft to hard and from fractured to massive states. The low-lying areas comprise recent alluvial deposits derived from adjacent upland materials.

Bedrock at the Los Vaqueros dam site consists of interbedded arkosic sandstone and claystone of the Panoche formation. The left abutment ridge is capped by a thick, resistant sandstone overlying less-resistant interbedded claystone sandstone and conglomerate. The right abutment is comprised mostly of claystone interbedded with sandstone and siltstone. Prominent sandstone outcrops are part of the same resistant sandstone found on the left abutment.

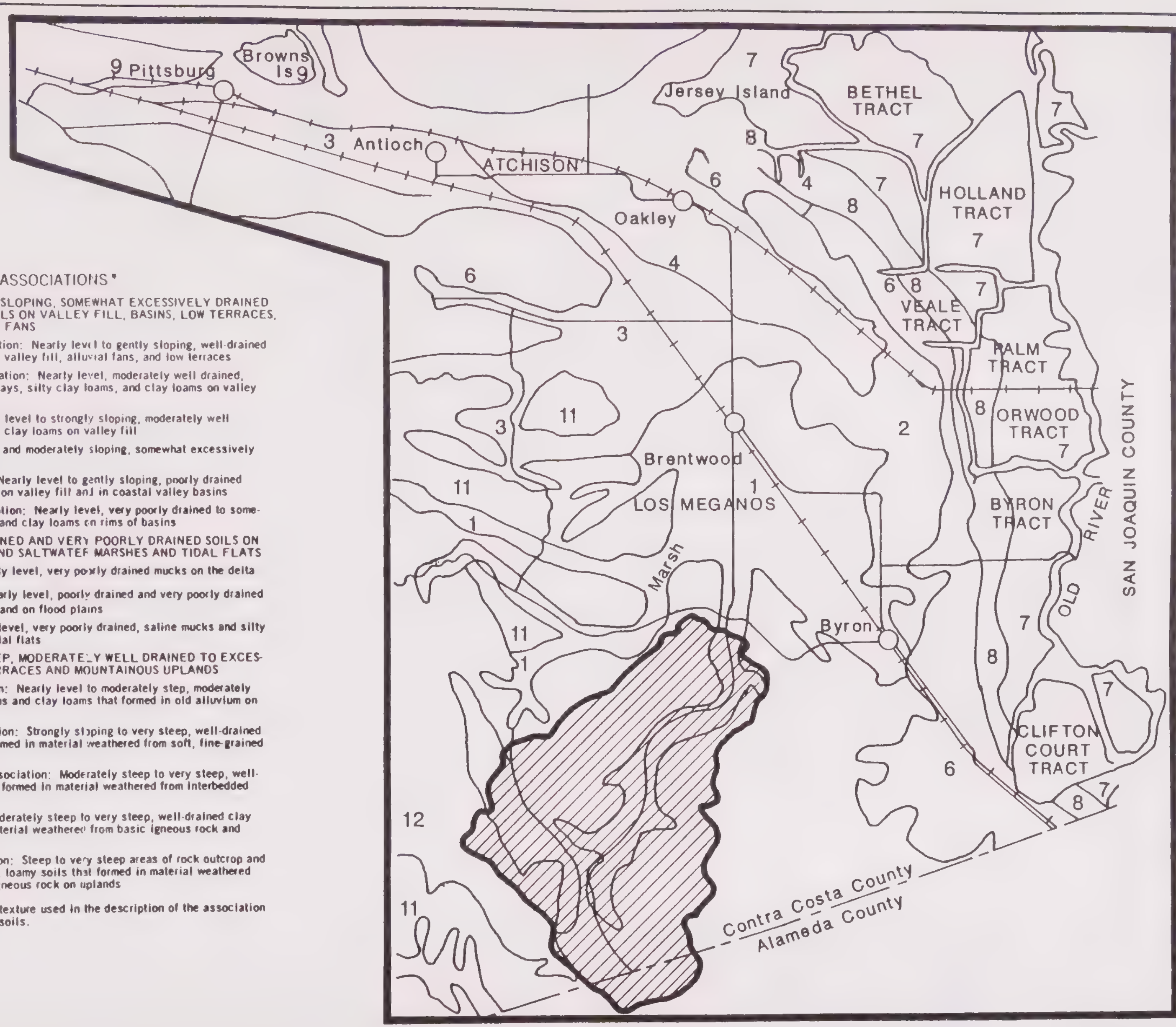
Table 10-1. Maximum Credible Earthquake Magnitudes in the Project Area

Fault	Maximum Credible Earthquake (Surface Wave Magnitude[a])
San Andreas (north coast segment)	8.5
Hayward	7.5
Calaveras (northern segment)	7.0
Coast Range - Sierra Block Boundary Zone (north-central segment)	6.5
Greenville (Greenville-Marsh Creek segment)	6.5
Antioch	6.5
Brentwood	6.0
Davis	6.2
Vaqueros	6.0
Kellogg	5.7
Camino Diablo	5.4

Notes:

[a] The surface wave magnitude scale is another scale used by seismologists to quantify the size of an earthquake. At magnitudes less than 7, the surface wave magnitude is approximately equivalent to Richter magnitude.

Source: Woodward-Clyde Consultants 1988b.



SOIL ASSOCIATIONS*

NEARLY LEVEL TO STRONGLY SLOPING, SOMEWHAT EXCESSIVELY DRAINED TO VERY POORLY DRAINED SOILS ON VALLEY FILL, BASINS, LOW TERRACES, FLOOD PLAINS, AND ALLUVIAL FANS

1 Brentwood Rincon-Zamora association: Nearly level to gently sloping, well-drained clay loams and silty clay loams on valley fill, alluvial fans, and low terraces

2 Capay Sycamore-Brentwood association: Nearly level, moderately well drained, poorly drained, and well drained clays, silty clay loams, and clay loams on valley fill and flood plains

3 Capay Rincon association: Nearly level to strongly sloping, moderately well drained and well drained clays and clay loams on valley fill

4 Delhi association: Gently sloping and moderately sloping, somewhat excessively drained sands in the valleys

5 Clear Lake-Cropley association: Nearly level to gently sloping, poorly drained and moderately well drained clays on valley fill and in coastal valley basins

6 Marcuse-Solano-Pescadero association: Nearly level, very poorly drained to somewhat poorly drained clays, loams, and clay loams on rims of basins

NEARLY LEVEL, POORLY DRAINED AND VERY POORLY DRAINED SOILS ON THE DELTA, FLOOD PLAINS, AND SALTWATER MARSHES AND TIDAL FLATS

7 Rindge-Kingile association: Nearly level, very poorly drained mucks on the delta

8 Sacramento-Omni association: Nearly level, poorly drained and very poorly drained clays and clay loams on the delta and on flood plains

9 Joice-Reyes association: Nearly level, very poorly drained, saline mucks and silty clays on saltwater marshes and tidal flats

NEARLY LEVEL TO VERY STEEP, MODERATELY WELL DRAINED TO EXCESSIVELY DRAINED SOILS ON TERRACES AND MOUNTAINOUS UPLANDS

10 Tierra-Antioch-Perkins association: Nearly level to moderately step, moderately well drained and well drained loams and clay loams that formed in old alluvium on terraces

11 Altamont-Diablo-Fontana association: Strongly sloping to very steep, well-drained clays and silty clay loams that formed in material weathered from soft, fine-grained sandstone and shale on uplands

12 Los Osos-Millsholm-Los Gatos association: Moderately steep to very steep, well-drained clay loams and loams that formed in material weathered from interbedded sedimentary rock on uplands

13 Gilroy-Vallecitos association: Moderately steep to very steep, well-drained clay loams and loams that formed in material weathered from basic igneous rock and metasedimentary rock on uplands

14 Rock outcrop-Xerorthent association: Steep to very steep areas of rock outcrop and excessively drained, very shallow, loamy soils that formed in material weathered from sedimentary rock and basic igneous rock on uplands

*Unless otherwise stated, the terms for texture used in the description of the association apply to the surface layer of the major soils.

Figure 10-3. General Soil Map of Eastern Contra Costa County

Source: U.S. Department of Agriculture Soil Conservation Service 1977

P–Prime Farmland

S–Farmland of Statewide Importance

U–Unique Farmland

L–Farmland of Local Importance

G–Grazing Lands

Figure 10–4. Important Farmlands in Eastern Contra Costa County

Bedrock at the Kellogg Dam site consists of Meganos sandstone on the right abutment and Deer Valley sandstone on the left abutment. The units are separated by a fault zone near the base of the right abutment beneath channel alluvium.

The Meganos sandstone consists of slightly weathered and weakly cemented silty sandstone and sandy siltstone with thin shaley interbeds and unweathered sandstone interbeds. The north side of the right abutment has been mined as a source of silica for glassmaking.

The Deer Valley sandstone consists of fine-grained sandstone and sandy siltstone.

Seismicity

Several earthquakes with Richter magnitudes of less than 6 have occurred in the project vicinity along faults that are considered to be active. Faults are considered active by the CDMG if they have had surface displacement during the Holocene period (about the last 11,000 years). The Greenville fault, west of the project area, is active and was the source of the 1980 Livermore earthquakes (magnitude 5-6). The Antioch fault and buried faults in the Coast Ranges-Sierran Block boundary zone are also sources of earthquakes.

Near the Los Vaqueros dam site, the Brentwood fault passes about 700 feet to the east of the dam. This fault is considered potentially active by CDMG. CDMG defines potentially active faults as those that have shown evidence of surface displacement during the Quaternary period (the last 2-3 million years).

The Los Vaqueros dam site is cut by small bedrock shear zones (faults) on the left abutment. The closest is 200 feet from the dam. These faults are not sources of earthquakes and would be treated during dam construction.

The Kellogg dam site consists of two east-west striking sandstone ridges separated by a splay of the potentially active Vaqueros fault. The main trace of the Vaqueros fault crosses the left abutment ridge west of the proposed dam.

Reservoir-Induced Seismicity

In 1945, a relationship was recognized between the level of water impounded at Hoover Dam and the frequency of earthquakes near Lake Mead. The relationship between reservoirs and earthquakes is referred to as "reservoir-induced seismicity" (RIS). Since 1945, 119 cases of RIS have been reported from the approximately 30,000 reservoirs worldwide (Woodward-Clyde Consultants 1991).

Reservoir-induced seismicity can be influenced by many factors, including reservoir size, reservoir geology, operation and filling characteristics, and preexisting tectonic stresses (stresses in the surface of the earth's crust). Seasonal water-level fluctuations and reservoir filling rates are two factors that influence tectonic stress changes beneath a reservoir, but reservoir-induced stresses alone are not sufficient to cause earthquakes. Under certain conditions, however, the stress changes caused by reservoir loading could trigger a seismic event in regions where stress conditions are already close to causing an earthquake (Woodward-Clyde Consultants 1991). The majority of significant cases of RIS are associated with reservoirs that have a much greater capacity or depth than would either the Los Vaqueros or Kellogg Reservoirs. In addition, as discussed below, most RIS events are of small magnitude and often occur unnoticed.

Reservoirs modify the tectonic stress regime by increasing elastic stress during reservoir filling and increasing subsurface pore pressures. For any particular site, the interaction between a reservoir and the geologic environment depends on local geologic and hydrologic conditions.

Soils

The two major soil associations found in the Kellogg Creek watershed are the Altamont-Diablo-Fontana association in upland watershed areas and the Brentwood-Rincon-Zamora association on the low-lying areas adjacent to Kellogg Creek.

The Altamont-Diablo-Fontana soils are characteristically, well-drained clays and silty clay loams that form on strongly sloping to very steep uplands. The soils are formed of material weathered from soft, fine-grained sandstone and shale and are moderately plastic with moderate to high expansion potentials. The erosion hazard varies from low to high depending on slope. Slumps, landslides, and rill and gully erosion are common on steep slopes in the watershed.

The Brentwood-Rincon-Zamora soils are well-drained clay loams and silty clay loams that form on nearly level surfaces. These soils are formed in alluvial material and are somewhat plastic with moderate to high expansion potentials. The erosion hazard is generally low.

SCS Land Capability Class I and II soils, considered the highest quality soils for agriculture, are found in the inundation area of both reservoir alternatives (Figure 10-5). Soils in these areas are generally not considered prime agricultural soils, however, because they are currently not irrigated and produce no high-value crops. CDC identifies these areas as farmlands of local importance (Figure 10-4).

Southeastern Contra Costa County

Other components of the various alternatives would be located generally in the eastern and northeastern portion of the project area near the Sacramento-San Joaquin Delta. None of the other components of the alternative would cross active or potentially active faults in the project area. Table 10-1 and Figure 10-2 summarize the active faults and locations of faults in the region.

Table 10-2 briefly describes terrain and lists the soil associations crossed by the major components of the various alternatives. Figure 10-3 provides a soil association map of northeastern Contra Costa County.

ENVIRONMENTAL CONSEQUENCES

This section identifies significant, significant and unavoidable, and less-than-significant geologic, seismic, and soil-related project impacts. Mitigation measures are described in a following section. Impacts are considered significant if they meet threshold criteria for significant geologic, seismic, and soil impacts. CDMG's 1982 Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports (Note 46) (California Division of Mines and Geology 1982) provides a checklist of potential geologic and seismic impacts that is used as a guide for identifying impact mechanisms. Soil resource significance criteria are based on SCS classification system for high-quality agricultural soils.

Criteria for Conclusions of Significance

Adverse impacts are considered significant if implementation of project alternatives could subject people, structures, or other resources to geologic or seismic hazards or disrupt, eliminate, or otherwise render unusable geologic or soil resources. Significant impacts would occur if:

- unique geologic or topographic features would be disturbed or eliminated;

Figure 10-5.
USDA Class I and II Soils Inundated by the Los Vaqueros and Kellogg Reservoirs

Source: U.S. Department of Agriculture Soil Conservation Service 1977

LEGEND

Reservoir Boundary

Class I and II Soils

0 1
Mile

Table 10-2. Geology and Soils Association Information for Other Project Components

Alternative Component	Terrain Geology	Soil Associations
Old River pipeline No. 1 and Clifton Court Pipeline	Nearly level to rolling terrain near Delta, rolling to steep near Kellogg Creek watershed	Altamont-Diablo-Fontana, Marcuse-Solano-Pescader, and Sacramento-Omni
Old River pipeline Nos. 2-6	Nearly level to rolling terrain consisting of deep alluvial materials	Brentwood-Rincon-Zanera and Capay-Sycamore-Brentwood
Middle River pipeline	Nearly level to rolling terrain consisting of deep alluvial materials	Capay-Rincon, Brentwood-Rivron-Zamera, and Capay-Sycamore-Brentwood
Intake facilities	Nearly level terrain consisting of deep alluvial materials	Ringe-Kingile
Camino Diablo Transfer Reservoir	Nearly level terrain consisting of the relatively dense and massive Markley sandstone, underlain by Nortonville shale	Brentwood-Rincon-Zanora
PG&E Hill Transfer Reservoir	Nearly level terrain consisting of quaternary terrance deposits	Altamont-Diablo-Fontana
Kellogg Creek Transfer Reservoir	Gently to moderately sloping terrain consisting of Markley sandstone	Altamont-Diablo-Fontana
Desalination plant facilities	Nearly level to gently sloping terrain consisting of deep alluvial materials	Capay-Rincon and Delhi

- active or proposed mineral development would be directly affected or disrupted by project construction or operation;
- high-quality mineral resources would be precluded from future development;
- project implementation would increase the potential for reservoir-induced seismicity;
- agricultural productivity of high-quality soils designated as prime, unique, or of statewide importance by CDMG would be reduced or eliminated by soil disruption, conversion, compaction, or overcovering; or
- implementation of an alternative could result in soil erosion conditions that adversely affect soil productivity or surface water resources.

No-Action Alternative

Impacts of the No-Action Alternative - Existing and Future Conditions

No geologic, seismic, or soil resource impacts would occur under the existing and future No-Action Alternative conditions. No new water delivery or storage system improvements would occur under existing conditions that would directly or indirectly affect geologic and soil resources or regional seismic conditions. Uncertainties about future system improvements under the No-Action Alternative future condition also create difficulties in predicting direct or indirect impacts because no plans for possible future improvements have been developed. Therefore, geologic, seismic, and soil impacts of the No-Action Alternative are considered less than significant for existing and future conditions. No mitigation is required.

Los Vaqueros Reservoir Alternative

Impacts of Dam and Reservoir Construction and Operation on Geology

Construction and operation of the Los Vaqueros dam and reservoir would not result in inundation or other disturbance of unique geologic or topographic features. The reservoir inundation area is a nearly level alluvial plain that slopes up to rolling hills common to the Coast Ranges. Rock outcrops are located on steep slopes and ridgelines in the Kellogg Creek watershed but are not found in the inundation area. Dam construction could disturb some rock outcrops on the east and west dam abutments, but these outcrops are not considered unique geologic formations.

Impacts on geologic and topographic features from dam and reservoir construction and operation would be less than significant. No mitigation is required.

Impacts of Project Area Seismic Conditions

The project area is located in Uniform Building Code Zone 4. A major earthquake on the San Andreas, Hayward, or Calaveras faults will cause strong ground shaking in the region. The probability of an earthquake of Richter magnitude 7 or greater occurring within the San Francisco Bay region during the next 30 years is approximately 67% (U.S. Geological Survey 1990).

An earthquake on the active Greenville fault west of the project area or the Brentwood fault could also cause substantial ground shaking in the project area. The Greenville fault could generate an MCE of

6.5 and the Brentwood fault a MCE of 6.0. The duration for ground shaking associated with possible earthquakes on these faults could be 12-20 seconds at the ground surface. An MCE on either fault could generate median peak horizontal ground accelerations of approximately 0.40 g (Woodward-Clyde Consultants 1988b).

The possibility that a seismic event may occur during the life of the project is considered an existing hazard that could affect project facilities; however, this potential hazard would not necessarily result from implementation of the project. Current seismic safety measures implemented as part of the project would eliminate or greatly reduce the potential for dam failure or appurtenant facility damage to a very low probability. The impact of constructing and operating the dam and appurtenant facilities in an active seismic area, therefore, would be less than significant.

Impacts of Reservoir-Induced Seismicity

The probability of a reservoir-induced earthquake occurring as a result of impounding water in the Los Vaqueros Reservoir is low to moderate (Woodward-Clyde Consultants 1991). Woodward-Clyde Consultants conducted a multivariate probablistic evaluation of reservoir-induced seismicity based on comparisons of other reservoirs worldwide in similar geologic, tectonic, and seismic settings. The results of this evaluation indicate that the conditional probability that a seismic event would occur as a result of impounding water in the Los Vaqueros Reservoir is 14%. This probability is consistent with an analysis of the hydrogeologic regime of the project area and based on a comparison with other northern California reservoirs.

Reservoir impoundment is capable of causing an earthquake only along critically stressed faults that are already close to the point at which an earthquake would naturally occur. If RIS were to occur, the most probable activity would be small-magnitude earthquakes (Woodward-Clyde Consultants 1991). The maximum magnitude of an earthquake is determined by the geometry and size of the rupture area. Because the reservoir would not alter these physical dimensions, the maximum reservoir-induced earthquake would not exceed the MCE for a given fault.

The timing of possible RIS events cannot be accurately predicted. Based on observations of other reservoirs in California, however, such events would be most likely to occur during periods when reservoir water levels fluctuate rapidly or during reservoir filling (Woodward-Clyde Consultants 1991). Rapid reservoir water-level fluctuations, which could enhance the possibility of a seismic event, would be unlikely at the Los Vaqueros Reservoir because the proposed reservoir would have a relatively high volume-to-depth ratio; large reservoir releases would result in only minor decreases in reservoir depth, thus minimizing tectonic stress changes beneath the reservoir.

If RIS were to occur, it would likely occur on faults beneath or near the reservoir, depending on the location of buried faults and the hydrogeologic characteristics of the region. Such events appear possible on the Brentwood fault but not on the Marsh Creek-Greenville fault because groundwater appears to flow away from the fault to the northeast (Woodward-Clyde Consultants 1991).

The potential for RIS associated with the Los Vaqueros Reservoir is considered to have only a moderate to low probability of occurrence. However, this would be a significant impact because the project, located in a seismically active region, would increase the potential for seismic events that could result in property damage or earthquake-related hazards. A review of likely CCWD reservoir operations indicates that CCWD does not plan to operate the reservoir in a manner that has been associated with RIS at other reservoirs. No mitigation measures are available to reduce this impact to a less-than-significant level. To partially reduce the probability of reservoir-induced seismicity, CCWD should monitor seismicity at the reservoir and, if significant levels of RIS occur, implement an operations management plan that requires gradual reservoir filling and restrictions on reservoir water-level fluctuations (Woodward-Clyde Consultants 1991).

Impacts of Dam and Reservoir Construction and Operation on Soil Resources

Approximately 970 acres of SCS Land Capability Class I and II soils of the Brentwood-Rincon-Zamora association are within the Kellogg Creek watershed, upstream of the proposed Los Vaqueros Reservoir dam site. These soils are primarily used for grazing and some dryland farming and are not considered prime farmlands because a reliable irrigation water supply is not available.

Implementing this reservoir alternative would directly or indirectly affect all 970 acres of the Class I and II soils. The reservoir would directly inundate approximately 760 acres of Class I and II soils and would indirectly prevent use of approximately 210 acres for agricultural purposes. Indirect loss of Class I and II soils would result from fragmentation of usable agricultural land located west of the reservoir inundation area (Figure 10-5). Fragmentation of this agricultural land would isolate potentially usable soils from existing watershed agricultural operations, thus reducing its value as productive farmland. Reservoir water quality objectives could also preclude using pesticides and fertilizers on farmland adjacent to the inundation area, further reducing the agricultural potential of the land.

Irretrievable commitment of 970 acres of Class I and II soil resources is considered a less-than-significant impact because none of the watershed soils are considered prime farmland, unique farmland, or farmland of statewide importance and because conversion of these soils would result in a relatively small proportional loss of moderately productive land compared to the amount of agricultural land currently in production in Contra Costa and Alameda Counties.

Impacts of Dam and Reservoir Construction and Operation on the Potential for Soil Erosion, Sedimentation, and Landslides

Soil Erosion. Construction of the Los Vaqueros Reservoir would require extensive earth-moving operations at the dam site that would disrupt normal soil conditions and remove ground cover. Soils at the dam site exhibit a high erosion potential that, combined with construction and grading activities, could substantially increase the potential for wind and water erosion on the slopes around the dam site.

Reservoir inundation could also contribute to soil erosion at the water's edge through several different mechanisms, including wind-generated wave action on shoreline slopes, wind erosion on denuded slopes in the water fluctuation zone, and bank slumping from shoreline soil saturation and water erosion.

Possible effects of severe water and wind soil erosion could include downstream sedimentation and scouring of Kellogg Creek, loss of soil productivity, and bank slumping at or near the reservoir's shoreline.

The extent and severity of soil erosion effects at the dam site and reservoir inundation area would depend largely on the method and success of site rehabilitation and revegetation in disturbed areas. Some soil erosion would probably occur on the steepest slopes regardless of the specific measures used. Soil erosion would be most severe at locations where denuded soils, steep cuts or fills, and fine sandy-to-silty soils are present.

Although it is difficult to predict the precise extent or consequences of soil erosion from construction and operation of the reservoir, the potential for soil erosion would be a significant impact. To reduce this impact to a less-than-significant level CCWD should implement a comprehensive erosion control and rehabilitation plan for construction sites and reservoir shoreline areas.

Siltation. The reservoir watershed is not expected to produce substantial amounts of sediment that would affect reservoir operations or water quality because the watershed is relatively small and most of the reservoir siltation would occur only during the winter and early spring streamflows. This impact would be less than significant. No mitigation is required.

Landslides. Surface landslides and minor slumping are common in the Kellogg Creek watershed, but none of the landslides upstream of the dam site are considered large enough to adversely affect the operation or safety of the reservoir. Rapid reservoir drawdown could aggravate old surface landslides or produce new slide areas. Minor surface landsliding in the watershed is expected to be represent a localized maintenance-level problem only (Woodward-Clyde Consultants 1988b). The potential for hazardous slides in and around the reservoir would be less than significant. No mitigation is required.

Impacts of the Conceptual Recreation Plan on Geology

The Los Vaqueros conceptual recreation plan staging areas, use areas, and trails would not substantially affect any unique geological or topographical features in the Kellogg Creek watershed. The plan concept has been designed to avoid unique bedrock outcrop areas along the dominant western ridge and in the eastern watershed. No impacts would occur and no mitigation is required.

Impacts of the Conceptual Recreation Plan on Soil Resources

Development of the conceptual recreation plan would involve siting staging areas, use areas, and trails on soils of the Brentwood-Rincon-Zamora and Altamont-Diablo-Fontana associations. The tram route would cross additional areas of Class I and II soils on the western side of the reservoir, and the research and conference center and education center would be sited on Class I and II soils. These impacts would be less than significant because construction and operation of the reservoir would substantially reduce the usefulness of these soils for agriculture and because these soils are not considered prime farmland or farmlands of statewide importance. No mitigation is required.

Impacts of Conceptual Recreation Plan on Soil Erosion, Sedimentation, and Landslides

The conceptual recreation plan would be designed to minimize the effects of soil erosion and reservoir siltation that could result from surface water flow over paved or compacted use areas and trails. Recreation sites would be graded and facilities constructed using best management practices for avoiding soil erosion. Refer to Chapter 3 for development guidelines related to soil erosion. This impact would be less than significant. No mitigation is required.

Landslide impacts associated with the conceptual recreation plan could occur near and upslope of the dam site. The tram route, which would require extensive cutting and filling, would cross upslope of a major block slide at the dam site. Any landslides or landslide remnants that could result in unstable slopes along the tram route would be removed or stabilized. This impact would be less than significant. No mitigation is required.

Impacts of Alternate Pipeline and Intake Facility Construction and Operation on Geology

Implementation of any of the alternate project configurations would not affect unique geological features. The alternate facilities would generally be located on nearly level alluvial and basin deposits. This impact is considered less than significant. No mitigation is required.

Impacts of Alternate Pipeline and Intake Facility Construction and Operation on Soil Resources

Construction of the alternate water conveyance pipelines could affect the productivity of prime agricultural soil resources. Table 10-3 lists the linear distance and acreage of important farmlands affected by each alternate project configuration.

Potential impacts on prime agricultural soil resources can be divided into four interrelated categories: irretrievable commitment to nonagricultural uses, increased erosion, soil horizons mixing, and soil compaction.

Intake Facility Construction. Implementation of the Rock Slough/Old River No. 2, Rock Slough/Old River No. 3, or Rock Slough/Old River No. 4 alternate project configurations would result in the irretrievable commitment of approximately 10 acres of prime agricultural soils to nonagricultural uses at the PG&E Hill transfer facility site. In addition, implementation of any of the Rock Slough/Old River alternate project configurations would result in the irretrievable commitment of approximately 12 acres of land designated farmland of statewide importance at the intake facility sites. These impacts would be significant. No mitigation is available to reduce impacts to less-than-significant levels.

Pipeline Construction. Soil erosion would not be a major consideration along most pipeline alignments. In isolated areas on steep slopes where unusual wind or water erosion occurs, or where a combination of fine sandy to silty soils occurs, soil productivity could be affected.

The extent and severity of soil loss from wind and water erosion would depend largely on rehabilitation success, the particular rehabilitation techniques employed, and the time it would take to reestablish a permanent, stable vegetative cover.

Mixing of soil horizons occurs when topsoil (or A horizon soils) is disturbed and mixed with subsoils during trenching operations for pipeline construction. Mixing can potentially disturb the fragile relationship of soil structure, soil nutrients, and soil microbiology. Mixing and burying the topsoil with relatively infertile subsoils may result in an overall decline in the soil's productivity. Subsoils may contain excessive salts or alkalinity that could adversely affect agricultural productivity or growth of vegetation.

The severity of this impact on agricultural lands depends on the nature of the subsoils' interaction with the topsoil, the net lowering of soil productivity, and the restoration potential. At some locations where the soils are very shallow or hardpan or claypan exists, mixing the soils may increase productivity by increasing the water-holding capacity of the soil.

Compaction of the soil during construction would temporarily affect the physical characteristics of the soil along the right-of-way and within the trench excavation area. Soils along the pipeline route would be compacted by heavy equipment during construction and operation. Compaction or rutting is mostly likely when soils are wet, and easily compacted soils could be irreversibly altered. Compaction can reduce a soil's productivity by lowering water infiltration, reducing the soil's water-holding capacity, increasing runoff and erosion, and adversely affecting the success of restoration efforts. Compacted soil makes seedbed preparation difficult during restoration.

The combination of soil erosion, horizon mixing, and compaction on soils designated as prime, unique, or of statewide importance that could occur during pipeline construction would be a significant impact. To reduce these effects to less-than-significant levels, CCWD should strip and store topsoil separately, avoid operation of heavy equipment during high precipitation periods, and rip subsoil horizons before replacing topsoil.

Impacts of Vasco Road and Utility Relocations

The relocation of Vasco Road and utility facilities could result in effects on slope instability, expansive and compressible soils, and soil erosion and sedimentation. These effects were considered significant impacts in the Vasco Road and Utility Relocation Project EIR and CCWD adopted mitigation measures to reduce the impacts to less-than-significant levels.

Kellogg Reservoir Alternative

The impacts of water conveyance pipelines, the intake facility, transfer reservoir, and other appurtenant facilities are identical to those identified for the Los Vaqueros Reservoir Old River No. 5 project configuration (Table 10-3). Refer to the Los Vaqueros Reservoir section above for discussion of the impacts of these facilities. Mitigation measures for significant impacts are described under the Los Vaqueros Reservoir Alternative in the "Mitigation Measures" section below.

Impacts of Dam and Reservoir Construction and Operation on Geology, Seismicity, and Soils

Construction and operation of the Kellogg Reservoir would have impacts on watershed geologic features similar to those identified for the Los Vaqueros Reservoir. Dam construction would require disruption of common bedrock outcrops, and reservoir inundation would avoid unique geologic formations in upland watershed areas. These impacts would be less than significant for the same reasons identified for the Los Vaqueros Reservoir Alternative. No mitigation is required.

The possibility that a seismic event may occur during the life of the project is considered an existing hazard that could affect project facilities; however, this potential hazard would not necessarily result from implementation of the project. Current seismic safety measures implemented as part of the project would eliminate or greatly reduce the potential for dam failure or appurtenant facility damage to a very low probability. The impact of constructing and operating the dam and appurtenant facilities in an active seismic area, therefore, would be less than significant.

RIS would increase the potential for small local seismic events (and less likely, but possibly events up to the MCE on nearby faults) and would be a significant impact. No mitigation measures are available to reduce this impact to a less-than-significant level. Refer to mitigation identified for the Los Vaqueros Reservoir Alternative for measures that could partially reduce this impact.

This alternative would result in direct and indirect commitment of Class I and II soils from dam construction, reservoir inundation, and land fragmentation effects. This impact would be less than significant because none of the affected soils are considered prime or unique farmland or farmland of statewide importance. No mitigation is required.

The effects of this alternative on soil erosion, sedimentation, and landsliding would be similar to the effects identified for the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

Impacts of Recreation on Geology, Seismicity, and Soils

Construction and operation of recreation facilities in and around the Kellogg Reservoir would have effects on watershed geology, seismicity, and soils similar to those described for the Los Vaqueros Reservoir Alternative. No unique geologic features or prime farmland would be lost; no substantial erosion, siltation, or landsliding would result from recreation facilities; and no impacts on regional or local seismicity would occur for the reasons described for the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

Impacts from Vasco Road and Utility Relocations

Impacts under this alternative would be identical to those described above under "Los Vaqueros Reservoir Alternative".

Table 10-3. Acreage of Prime and Unique Soils and Soils of Statewide Importance Affected under Each Project Alternative

Land Classification	Los Vaqueros Reservoir Alternative: Rock Slough/ Old River No. 1 Configuration	Rock Slough/ Old River No. 2 Configuration	Rock Slough/ Old River No. 3 Configuration	Rock Slough/ Old River No. 4 Configuration	Rock Slough/ Old River No. 5 Configuration	Rock Slough/ Old River No. 6 Configuration	Clifton Court Forebay/ Old River Configuration	Kellogg Reservoir Alternative	Desalination/ EBMUD Emergency Supply Alternative	Middle River Intake/ EBMUD Emergency Supply Alternative
Prime farmland	82	167	182	185	106	119	53	106	113	130
Irretrievably committed	–	10	10	10	–	–	–	–	99	–
Unique farmland	14	3	4	6	10	10	13	10	2	2
Irretrievably committed	–	–	–	–	–	–	–	–	–	–
Farmland of statewide importance	40	29	51	41	47	49	0	47	46	34
Irretrievably committed	12	12	12	12	12	12	–	12	–	12
Total	148	221	259	254	175	190	66	175	260	178

Desalination/EBMUD Emergency Supply Alternative

Impacts of Desalination Plant and Pipeline Construction and Operation on Geology, Seismicity, and Soils

Construction and operation of the Desalination/EBMUD Emergency Supply Alternative would have impacts on geologic features and regional seismicity similar to those identified for the alternate pipelines and intakes under the Los Vaqueros Reservoir Alternative. No unique geologic features would be affected because the facilities would be located on alluvial material and basin deposits, and no substantial seismic impacts would occur. These impacts would be less than significant. No mitigation is required.

Construction of the desalination plant would result in the irretrievable commitment of 99 acres of prime agricultural soils to nonagricultural uses. This impact would be significant. No mitigation is available.

Construction of water conveyance pipelines under this alternative could affect the productivity of prime agricultural soils. Table 10-3 lists the linear distance and acreage of important farmlands affected. This impact would be significant. To reduce this impact to a less-than-significant level, CCWD should strip and store top soils separately, avoid operation of heavy equipment during high precipitation periods, and rip subsoil horizons before replacing topsoil.

The effects of this alternative on soil erosion and sedimentation would be similar to the effects identified for other pipeline and intake alternatives under the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

Middle River Intake/EBMUD Emergency Supply Alternative

Impacts of Pipeline and Intake Facility Construction and Operation on Geology, Seismicity, and Soils

Construction and operation of the Middle River pipeline and intake facilities would have impacts on geologic features and regional seismicity similar to those identified for the alternate pipelines and intakes under the Los Vaqueros Reservoir Alternative. No unique geologic features would be affected because the facilities would be located on alluvial material and basin deposits, and no substantial seismic impacts would occur. These impacts would be less than significant. No mitigation is required.

Intake Facility Construction. Implementation of this alternative would result in the irretrievable commitment of approximately 12 acres of land designated as farmland of statewide importance at the intake facility site. This impact would be significant. No mitigation is available.

Pipeline Construction. Construction of the Middle River pipeline would affect prime agricultural soil resources. Table 10-3 lists the acreage of important farmlands affected by this alternative. This impact is considered significant. To reduce this impact to a less-than-significant level, CCWD should strip and store topsoils separately, avoid operation of heavy equipment during high precipitation periods, and rip subsoil horizons before replacing topsoil.

The effects of this alternative on soil erosion, sedimentation, and landsliding would be similar to the effects identified for other pipeline and intake alternatives under the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

MITIGATION MEASURES

No-Action Alternative

No mitigation is required.

Los Vaqueros Reservoir Alternative

Impacts of Reservoir-Induced Seismicity

10-1: Monitor Seismicity and Implement a Reservoir Operations Management Plan. A review of likely CCWD reservoir operations indicates that CCWD does not plan to operate the reservoir in a manner that has been associated with RIS at other reservoirs. CCWD should monitor seismicity in the vicinity of the reservoir and, if RIS occurs at a significant level, implement a reservoir operations management plan to minimize the potential for reservoir-induced seismicity. Possible reservoir management practices could involve gradual filling of the reservoir or operating the reservoir to minimize water-level fluctuations.

To estimate if RIS is occurring, CCWD should install one high-sensitivity seismograph station to increase monitoring and detection capabilities for earthquakes in the project area. The station should be operated at least 1 year before reservoir impoundment to monitor normal background seismicity and then continuously throughout the life of the project. If seismicity is detected, at least two additional stations should be installed. The increased monitoring sensitivity provided by the seismograph stations would greatly improve CCWD's ability to recognize a reservoir-induced seismic event. If such an event occurred, the seismic information gained would be used to refine reservoir operations to minimize risks of future occurrences.

Impacts of Dam and Reservoir Construction and Operation on Soil Erosion

10-2: Implement a Comprehensive Erosion Control and Restoration Plan. CCWD should prepare and implement an erosion control and restoration plan to control short-term and long-term erosion and sedimentation effects and to generally restore preproject topography, water resources, soils, and vegetation in areas affected by construction activities.

Features of the plan should include, at a minimum, the following measures:

- Construct the project and rehabilitate disturbed areas to a uniformly high standard in all construction areas involving site clearing, excavation, or other soil manipulations.

- Restore, to the extent practicable, original landscape contours at construction sites unless otherwise directed by a geotechnical engineer.

- Salvage, protect, and use the high-quality soils for revegetation.

- Implement best management practices for erosion and sediment control as required.

Impacts of Alternate Pipeline and Intake Facility Construction and Operation on Geology, Seismicity, and Soils

10-3: Implement Construction Methods for Reducing Soil Impacts. CCWD should implement construction methods that minimize the effects of soil erosion, horizon mixing, and soil compaction on prime or other important soil resources by:

- stripping and storing prime and other important topsoils (horizon A soils) separately from subsoils in pipeline rights-of-way (stored topsoil should be protected to minimize wind or water erosion);
- avoiding compacting soils outside the pipeline right-of-way by limiting truck or heavy-equipment operation to the right-of-way;
- avoiding operation of heavy equipment during high precipitation periods; and
- ripping subsoil horizons to minimize effects of soil compaction.

No mitigation measures are required for less-than-significant impacts.

Kellogg Reservoir Alternative

Impacts of Reservoir-Induced Seismicity

Implement a Reservoir Operations Management Plan. Refer to the discussion of mitigation measure 10-1 above under the Los Vaqueros Reservoir Alternative for details of this measure.

Impacts of Dam and Reservoir Construction and Operation on Soil Erosion

Implement a Comprehensive Erosion Control and Restoration Plan. Refer to the discussion of mitigation measure 10-2 under the Los Vaqueros Reservoir Alternative for details of this measure.

Impacts of Alternative Pipeline and Intake Facility Construction and Operation on Geology, Seismicity, and Soils

Implement Construction Methods for Reducing Soil Impacts. Refer to the discussion of mitigation measure 10-3 under the Los Vaqueros Reservoir Alternative for details of this measure.

Desalination/EBMUD Emergency Supply Alternative

Impacts of Pipeline Construction on Prime Agricultural Soils

Implement Construction Methods for Reducing Soil Impacts. Refer to the discussion of mitigation measure 10-3 under the Los Vaqueros Reservoir Alternative for details of this measure.

Impacts of Alternative Pipeline and Intake Facility Construction and Operation on Geology, Seismicity, and Soils

Implement Construction Methods for Reducing Soil Impacts. Refer to the discussion of mitigation measure 10-3 under the Los Vaqueros Reservoir Alternative for details of this measure.

Chapter 11. Cultural Resources

AFFECTED ENVIRONMENT

Introduction

The National Park Service initiated cultural resource studies for the Los Vaqueros Project in 1964; however, it was not until 1979, when DWR was considering the Los Vaqueros Reservoir site, that more intensive archeological work began. For the last 12 years, this work has been nearly continuous and is still ongoing. During this time, hundreds of archeological and architectural properties have been recorded, making this once little-known area one of the most intensively studied areas in northern California.

Applicable Laws and Regulations

In addition to meeting the requirements of CEQA and NEPA, the alternative selected through this EIR/EIS must comply with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (1980), and its implementing regulations, 36 CFR 800. Section 106 requires that federal agencies take into account the effects of their actions on properties that may be eligible for or listed in the National Register of Historic Places (NRHP). To determine if an undertaking could affect NRHP-eligible properties, cultural sites (including archeological, historical, and architectural properties) must be inventoried and evaluated for their eligibility for inclusion in the NRHP. For this project, compliance with Section 106 is the responsibility of Reclamation, the federal lead agency.

The Section 106 process is implemented using a five-step procedure, as applicable: 1) identification and evaluation of historic properties; 2) assessment of the effects of the undertaking on properties that are eligible for the NRHP; 3) consultation with the State Office of Historic Preservation (OHP) and other agencies for the development of a memorandum of agreement (MOA) that addresses the treatment of historic properties; 4) receipt of Advisory Council on Historic Preservation comments on the MOA or results of consultation; and 5) implementation of the project according to the conditions of the MOA.

The American Indian Religious Freedom Act (AIRFA) of 1978 is also applicable. This act makes it "the policy of the United States to protect and preserve for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions . . . including but not limited to access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites (P.L. 95-431)." If Native American remains, funerary or sacred objects, or objects of cultural heritage are found on federal lands, compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 will be required. Regulations for this act are being developed.

Section 7052 of the Health and Safety Code and Section 5097 of the Public Resources Code provide for the protection of Native American remains and identify special procedures to be followed when Native American burials are found. When remains are found, the Native American Heritage Commission (NAHC) and the county coroner must be notified, and the NAHC provides guidance concerning the most likely Native American descendant and the treatment of human remains and associated artifacts.

Definition of Key Terms

Archeological sites are locations where past human activities occurred and cultural materials have accumulated. Archeological sites can include both surface and subsurface cultural remains. In California, prehistoric sites date from more than 10,000 years ago to the late 1700s and are the result of Native American activities. Historic sites in California generally date from the late 1700s (when the keeping of written records began) to the first part of the 20th century and are primarily the result of Euroamerican activities. Ethnohistoric sites date from the period of contact between the Native Americans and Euroamericans (the late 1700s into the 1900s).

Many sites in the project area and elsewhere in California contain both prehistoric and historic components. This is expected because the same physical features of the area appealed to both the Native Americans and the Euroamericans.

Architectural properties are defined as standing structures or buildings. In the project area, all standing structures are the result of Euroamerican occupation of the area. Some architectural properties are found in association with historic archeological sites.

"Cultural resources" is a generic term used here to describe prehistoric, historic, and architectural resources. The term "historic properties" also includes all the above categories but refers only to resources that are determined to be eligible for listing in the NRHP.

Delineation of the Area of Potential Effect

When cultural resources studies were initiated for the Los Vaqueros Project, a general study area was defined, which was altered as the project evolved. Previously, the terms "project area" and "study area" were used interchangeably to refer to any area being examined for cultural resources as part of the project. Recently, the project description has become more refined, allowing for a better definition of the actual areas of potential impact. Section 106 requires the identification of the area of potential effect (APE). The APE conforms to the geographic area within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist (36 CFR 800.2).

The APE should include all areas where an undertaking may cause changes to land or structures or to their uses, whether the changes would be direct or indirect, beneficial or adverse. The APE should include:

- all alternative locations for elements of the undertaking;
- all locations where the undertaking may result in ground disturbance;
- all locations from which the elements of the undertaking (e.g., structures or land disturbances) may be visible; and
- all locations where the activity may result in changes in traffic patterns, land use, and public access (36 CFR 800.2[c]).

Cultural Resources Studies Undertaken to Date

Cultural resources studies for the Los Vaqueros Project began in 1964, when archeologists from San Francisco State University, working under the National Park Service, surveyed the then-proposed Kellogg Reservoir area (Treganza 1964). In 1967, a large prehistoric site in the project area (CA-CCO-310) was excavated (Hardy 1967).

A hiatus followed until 1979, when a student from California State University, Hayward, began excavations at CA-CCO-417 (Parkman 1979). That same year students from California State University, Sacramento, prepared a planning summary and recommendations for preliminary field studies for several reservoir locations, including the Los Vaqueros Reservoir site (Russo and McBride 1979). Shortly thereafter, DWR contracted with Sonoma State University (SSU) to perform cultural resources surveys for the project. SSU has continued work for the Los Vaqueros Project under contract with CCWD. These studies have been directed by David A. Fredrickson, Ph.D., who has been assisted by SSU graduate students.

SSU began its first study for DWR in 1981, which consisted of a cultural resources inventory of the Los Vaqueros Reservoir and Kellogg Forebay areas (Fredrickson 1982). The study included an overview of previously identified resources, background research, and a field reconnaissance of 8,100 acres. Ethnographic research was an important element of this study. Ethnohistoric and ethnolinguistic data were collected to help determine the prehistoric and protohistoric occupants of the Los Vaqueros area.

In 1986, SSU conducted a survey for the Kellogg Reservoir site for CCWD (Eidsness 1986). Historical research was conducted and 1,030 acres were surveyed for this study.

In 1988, SSU surveyed an additional 7,000 acres of land within the Kellogg Creek watershed for CCWD (Bramlette et al. 1988). Its report documented the findings of the survey, summarized the previous reports, and made management recommendations for each site within the project area, as it was then defined.

For CCWD's Vasco Road and utility relocation project, surveys were conducted in 1989 and 1990 of the areas not previously examined during earlier reconnaissance surveys (Bramlette et al. 1990). This report presented the findings of the field reconnaissance, summarized the findings of the previous studies, and provided recommendations for the selection of road and utility alignment alternatives.

Most recently, SSU undertook a study for the alternate water conveyance pipelines, desalination plant, and related facilities. Also included in this report were findings from the reconnaissance of areas near Round Valley, which could not be surveyed previously because of lack of access.

The results of several other cultural resource investigations have also been used in this analysis, including those for proposed windfarm developments, proposed landfill projects, and two smaller developments (Bramlette 1987; Holman 1982, 1983, 1984a, 1984b, 1985; Holman et al. 1985; Keswick and Bramlette 1987; Neeley 1978; Porter et al. 1980; Wigerg 1984). Additionally, portions of the investigations for the East County Corridor Study overlapped with the Los Vaqueros Project area (Fredrickson et al. 1988), the findings of which have been incorporated into this study.

SSU prepared a summary archeological inventory report that provides a synopsis of all sites within the APE for the project, their potential eligibility for inclusion in the NRHP, and recommendations for further work. This report provided the basis for Reclamation's initiation of consultation with the OHP and was used to guide future cultural resource evaluation and mitigation efforts.

An architectural inventory of the properties located within the APE was completed in late 1991. This report documented the findings of their 1991 architectural inventory and provided preliminary evaluations and recommendations for treatment of architectural properties within the project's APE.

In terms of Section 106 compliance, studies conducted to date have focused on completing the inventory of cultural resources. Evaluation of cultural resource sites, assessment of effects, and mitigation measures will be performed concurrently with the environmental review process. A programmatic agreement between CCWD, OHP, the Advisory Council on Historic Preservation, and Reclamation is being drafted that will specify how and when Section 106 compliance will occur.

Study Methods

Background Research

Before fieldwork, a records and literature search was conducted at the Northwest Information Center of the California Archaeological Inventory and at the Cultural Resources Facility, SSU. Archeological base maps and site records were consulted to determine if any part of the study area had been previously surveyed and if previously recorded sites had been identified in the study area and to assess the overall sensitivity of the study area for cultural resources.

Ethnographic maps were examined to determine if Native American villages or campsites had been identified within the study area. For historic resources, maps compiled for the East County Corridor Study and the data already collected were consulted. Additional research was also conducted at the map room, Doe Library, and The Bancroft Library, University of California, Berkeley; in addition, BLM survey records in Sacramento were consulted.

Focused historical, prehistoric, and ethnographic research was conducted for the project area. Additionally, literature pertinent to the prehistoric environment of the project area was examined, and general models of environmental change relative to use of the land were reviewed. From this analysis, models were developed that focused on seasonally oriented resource exploitation and human adaptations to environmental change. This research helped direct field investigations and formulate research questions for future work.

Contacts with Agencies, Native Americans, and Knowledgeable Individuals

Native Americans and state agency officials were contacted for information regarding cultural resources in the project area, including:

- Glen Villa, Ione Tribal Council;
- Dwight Dutschke, Amador Tribal Council;
- Larry Myers, California Native American Heritage Commission; and
- Kathryn Gualtieri, State Historic Preservation Officer.

Interviews were also conducted with individuals who are knowledgeable about cultural resources in the project area.

Field Methods

Field methods used to identify cultural resources within the project area have varied, depending on the goal of the survey and the different geographic regions under examination. Mixed-strategy field reconnaissance has been employed over the majority of the project area. Efforts were concentrated in areas of high or moderate archeological sensitivity, consisting primarily of areas with slopes of less than 35% where prehistoric or historic occupation would have been likely (i.e., near desirable resources). Rock

outcrops, ridgetops, descending ridges, and knolls were intensively inspected. Areas with slopes greater than 35% and excessively brushy areas were inspected less intensively.

All newly identified archeological sites were recorded, and previously recorded sites were updated on new archeological site record forms. Site information was forwarded to the Northwest Information Center of the California Archaeological Inventory at SSU.

Cultural Context

Prehistoric Period

Human occupation of eastern Contra Costa County is thought to extend back at least 3,000-3,500 years but the area was probably occupied more intensively during the last 1,000-2,000 years. In the period preceding Euroamerican contact, native peoples speaking four languages (Ohlone or Costonoan, Bay Miwok, Plains Miwok, and Northern Valley Yokuts) lived in and around the Kellogg Creek watershed. No data have been found that link one of these groups to the area more clearly than another. Rather, it appears that major villages of each group were located outside the watershed, and that the area was probably used for seasonal resource exploitation by more than one group. The closest major population center may have been near Marsh Creek Springs or Round Valley, where the Bay Miwok tribelet center of "Wolwon" is thought to have been located.

Consultations with the Amador Tribal Council in 1982 revealed that people from the Ione area still retain heritage ties to the project area. According to tribal accounts, some of the ancestors of Native Americans living in the Ione area came from the Livermore and Pleasanton area to escape abuse from the Spanish and other Euroamericans (Fredrickson 1982).

Historic Period

In the mid-1700s, the Spanish moved from Mexico into Alta California, establishing defensive and religious settlements along the coast. The establishment of two missions in the vicinity of the project area, Mission San Francisco de Asis in 1776 and San Jose de Guadalupe in 1797, resulted in the removal of most Native Americans in the area to one of the two Spanish settlements. This displacement of native peoples made the area more attractive to the Euroamerican settlers who began entering the area around this time.

In 1822, following the Mexican revolution and secularization of the missions, large tracts of mission lands were granted to Mexican citizens. In 1835, Jose Noriega claimed Rancho Los Meganos, which makes up the present-day watersheds of Marsh and Kellogg Creeks. John Marsh, an American, later purchased Rancho Los Meganos from Noriega in 1838. Unlike many of the Mexican rancho owners of the area who lived in San Jose with their families, Marsh first built an adobe home on Marsh Creek and later built a stone house.

In 1844, the southern portion of the Marsh rancho and the majority of the Kellogg Creek drainage were ceded to Alviso, Higuera, and Miranda as Rancho Canada de los Vaqueros (Valley of the Cowboys). Native American vaqueros in Alviso's employ lived on the ranch and tended the cattle.

During the rancho period, cattle were raised primarily for the hide and tallow trade, because there was virtually no market for the large quantities of beef produced. The California gold rush, however, created a huge demand for meat, and the orientation of ranchers changed dramatically. During the great cattle boom of 1850-1860, Spanish cattle were gradually replaced with improved purebred stock.

Stock raising was the main livelihood of residents in eastern Contra Costa and Alameda Counties until the mid-1860s, when large-scale farming supplanted ranching as the major industry. As grain crops became more valuable and easily marketable, especially after the establishment of the railroads, cattle grazing was moved to the hills. Many ranchers began raising sheep, which were better adapted to California's semi-arid climate.

In 1847, an undivided half interest in the Los Vaqueros Rancho was transferred to Noriega and Robert Livermore, who also owned the Rancho Los Positas to the south. By the time ownership of the rancho was confirmed for Livermore in 1855, undivided interests in the Los Vaqueros Ranch were held by five families. The land eventually came under the ownership of Mary Crocker, who leased it to at least six other ranchers, many of whom were recent immigrants from France, Germany, and Portugal. John Elliot was probably the only owner-occupier of the Los Vaqueros Rancho. When Elliot died in 1911, he was buried on Brushy Peak, as requested in his will.

In the late 1800s and early 1900s, much of the area was occupied by tenant farmers who leased land from absentee landlords such as Mary Crocker. In the mid-20th century, the property became consolidated and landowner occupied again and many of the former tenant dwellings were abandoned.

Study Findings

Studies for the project area have identified both new and previously recorded cultural resource sites and architectural properties within the tentative APE. The Stage 2 EIR/EIS Technical Report (bound separately) provides a list of sites by project component, which could be affected by the project. This tentative APE will be finalized when decisions concerning project design are reached.

ENVIRONMENTAL CONSEQUENCES

Criteria for Conclusions of Significance

Significant Impacts

Cultural resource significance is evaluated in terms of eligibility for listing in the NRHP. NRHP criteria for eligibility are defined as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and that:
>
> - are associated with events that have made a contribution to the broad pattern of our history;
> - are associated with the lives of people significant in our past;
> - embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

- have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.6).

Significant impacts can occur when prehistoric or historic archeological sites, structures, or objects listed or eligible for listing in the NRHP are subjected to the following:

- physical destruction or alteration of all or part of the property;

- isolation of the property from or alteration of the property's setting when that character contributes to the property's qualification for the NRHP;

- introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting;

- neglect of a property that result in its deterioration or destruction; and

- transfer, lease, or sale of the property (36 CFR 800.9).

Under CEQA, an impact is considered significant if the project may cause damage to an important cultural resource, which is described as:

- being associated with an event or person of recognized significance in California or American history, or recognized scientific importance in prehistory;

- providing information which is both of demonstrable public interest and useful in addressing scientifically consequential and reasonable or archeological research questions;

- having a special or particular quality such as oldest, best example, largest, or last surviving example;

- being at least 100 years old and possessing substantial stratigraphic integrity; or

- being able to address important research questions that historical research has shown can be answered only with archeological methods (State CEQA Guidelines Appendix K).

Impacts would be significant under NEPA if a project would diminish the integrity of a resource's location, design, setting, materials, workmanship, feeling, or association; or cause the loss or destruction of significant scientific, cultural, or historical resources (40 CFR 1508.27).

Section 106 of the National Historic Preservation Act requires federal agencies to consider impacts of projects on traditional cultural values. Significant impacts would occur if areas with contemporary or sacred values to Native Americans would be adversely affected by the alternatives.

Beneficial Impacts

An impact would be considered beneficial if it would result in the protection, stabilization, or restoration of cultural properties listed in, or eligible for listing in, the NRHP, or sites determined to be important under CEQA.

Less-Than-Significant Impacts

Less-than-significant impacts would occur if sites determined ineligible for listing in the NRHP or sites not considered important under CEQA were affected by the alternatives.

Key Assumptions

The primary key assumption in assessing an alternative's effects on cultural resources is that when prudent and feasible, impacts on cultural resources sites will be avoided.

Impact Mechanisms

The alternatives considered in this EIR/EIS could affect historic, archeological, architectural, or traditional cultural properties eligible for the NRHP. Impacts could result from the physical disturbance of cultural resources during construction or construction-related activities, including the demolition, removal, or alteration of historically or architecturally significant structures; management practices for watershed lands; and the introduction of visual elements that could alter the setting, integrity of location, or feeling associated with historic properties. The specific impacts that could affect historic properties are listed below for each alternative.

The alternatives could affect cultural resources either directly or indirectly. Direct impacts result from destroying historic properties or damaging the values that make them NRHP-eligible. Demolition or inundation of historic buildings and bulldozing an archeological site are examples of direct impacts. Indirect impacts or secondary impacts, such as vandalism, erosion, and flooding, can follow construction activities.

Impact Mechanisms Specific to the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Facility Construction. Impacts from facility construction have the greatest potential to affect cultural resources, largely because of the ground-disturbing activities associated with construction. The following are the preliminary APE for facility construction:

- dam construction areas, the reservoir inundation area, the quarry site, the spillway, and inlet and outlet facilities;
- recreational facilities, such as picnic and camping areas, trails, access roads, staff housing, maintenance and interpretive facilities, and concession locations;
- water conveyance systems, including intake facilities, transfer reservoirs, pumping plants, associated electric transmission lines, and the Neroly blending facility; and
- Vasco Road relocation and utility relocation alignments.

Incidental Construction Activities. Impacts on cultural resources could result from incidental construction activities such as material preparation and storage, spoil disposal, vehicle and heavy equipment traffic on access roads, staging areas, increased erosion, and vandalism during construction.

Reservoir Operation, Land Use, and Management. Management and operation of the Los Vaqueros or Kellogg Reservoirs and watershed could result in beneficial and adverse impacts on historic properties. Impacts could occur from purchase of watershed lands, reservoir operation, grazing practices,

fire suppression, recreation-related increased visitation, wind farm development, and development research and educational facilities.

Purchase of Watershed Lands. Purchasing watershed lands could protect sites that are not affected by constructing the alternatives. Watershed lands will be managed to protect cultural resources from loss or damage.

Reservoir Operation. Fluctuating reservoir levels and the amount of water released into Kellogg Creek could affect historic properties near the reservoir high-water mark and downstream of the dam. Fluctuating water levels and hydrodynamic action could erode and degrade historic properties located at the water's edge. Changes in the amounts of water released from the reservoir could increase downstream erosion, which could affect historic properties. Conversely, if consistent water release amounts were maintained, downstream erosion could be controlled. CCWD's reservoir operation would decrease peak flows in Kellogg Creek downstream of the dam, resulting in more stable flow levels in the creek.

Land Management: Grazing Practices. Changes in grazing practices could beneficially or adversely affect historic properties. Number of livestock per acre, livestock distribution, and season and duration of grazing can influence whether historic properties could be adversely affected by grazing practices. Reducing or restricting grazing in areas where sensitive cultural resources are located could result in beneficial impacts. Conversely, if overgrazing continues, additional adverse impacts on historic properties could occur.

Land Management: Fire. Changes in fire management practices could either benefit or adversely affect historic properties. Management practices that reduce the risk of historic structures and buildings catching fire and controlled burning that avoids and protects prehistoric sites from wild fires would be beneficial.

Adverse impacts could result from burning the ground above prehistoric sites because intense heat can damage cultural materials beneath the ground. Creating fire breaks and scrubbing vegetation on or near historic properties could also cause adverse impacts.

Land Management: Dryland Farming. Continued dryland farming could adversely affect historic properties. Discing and plowing agricultural fields results in mixing cultural deposits, often destroying the contextual characteristics that make them significant.

Land Management: Windfarm Development. Constructing new wind turbines and access roads for windfarm development could adversely affect historic properties.

Land Use: Recreation-Related Increased Visitation. Recreation-related increased visitation could result in adverse impacts on historic properties. Both the watershed and Vasco Road relocation areas could receive more visitors, which could result in increased vandalism of historic properties in these areas.

Land Use: Research and Education. CCWD's management plan for cultural resource educational and interpretive facilities could promote preservation of historic properties. Better understanding and appreciation of cultural resources could result in reduced vandalism, which would be a beneficial impact.

Impact Mechanisms Specific to the Desalination/EBMUD Emergency Supply Alternative

Facility Construction Impacts. Constructing the desalination facilities, including the desalination plant, brine disposal pipeline, EBMUD intertie pipeline, and associated transmission lines could result in impacts on cultural resources.

Incidental Construction Activities. Impacts on cultural resources could result from incidental construction activities such as material preparation and storage, spoil disposal, vehicle and heavy equipment traffic on access roads, staging areas, increasing erosion, and vandalism during construction.

Impact Mechanisms Specific to the Middle River Intake/EBMUD Emergency Supply Alternative

Facility Construction Impacts. Constructing the Middle River Intake/EBMUD Emergency Supply Alternative facilities, including the Middle River intake facility and pumping plant, Middle River pipeline, EBMUD intertie pipeline, Neroly blending facility, and associated transmission lines, could cause impacts on cultural resources.

Incidental Construction Activities. Impacts on cultural resources could result from incidental construction activities such as material preparation and storage, spoil disposal, vehicle and heavy equipment traffic on access roads, staging areas, increased erosion, and vandalism during construction.

Assessment of Impacts

Work conducted to date has provided an inventory of cultural resources within the APE for the project alternatives. None of the sites have been evaluated for their NRHP eligibility. The following assessment of impacts, therefore, assumes that all sites within the APE for each alternative are eligible for the NRHP, that the prehistoric sites may contain values of sacred importance to Native Americans, and that impacts on these sites would be significant. Subsequent to NRHP evaluation, the impacts of the project on an NRHP-eligible site will be determined more specifically. Mitigation measures discussed below include the necessary steps to determine NRHP eligibility and the recommended measures to mitigate impacts on historic properties.

No-Action Alternative

Project Vicinity. Under the recently adopted Contra Costa County general plan (Contra Costa County Community Development Department 1991), most of the project vicinity would remain agricultural. Land conversion is only expected adjacent to Discovery Bay, north of the watershed, and near Byron Hot Springs.

Kellogg Creek Watershed. Existing land uses in the Kellogg Creek watershed are expected to continue. These activities, such as dryland farming, grazing, and windfarm development, have adversely affected cultural resources in the past and are expected to have incremental adverse impacts on historic properties.

Los Vaqueros Reservoir Alternative

The discussion of impacts under this alternative is divided into the seven alternate project configurations.

Rock Slough/Old River No. 1 Configuration

Facility Construction: Dam, Reservoir, and Related Facilities. Constructing the dam and spillway and filling the reservoir would result in the destruction of four historic archeological sites, four prehistoric sites, two sites with both prehistoric and historic components, and one historic architectural property.

Facility Construction: Recreational Facilities. The recreational facilities described in the conceptual recreation plan are designed to avoid impacts on cultural resources; however, some facility locations and increased access to the area for recreational use could result in direct and indirect impacts on cultural resources. Eight cultural resource sites are located within the APE for recreational facilities. Of these sites, four are prehistoric, two are historic, and two consist of both historic and prehistoric components.

Facility Construction: Water Conveyance Facilities. One historic site, three prehistoric sites, and one site with both prehistoric and historic components are located within the study area for the Old River No. 1 water conveyance corridor. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along this corridor.

The Old River No. 1 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

No known archeological sites exist within the study corridor for the Los Vaqueros pipeline; however, the pipeline would pass through areas with potential for buried deposits. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

An inventory of architectural properties indicates that there are six architectural properties dating before 1945 located along the Los Vaqueros pipeline corridor.

Incidental Construction Activities. Whether cultural resources sites could be affected by incidental construction activities is unknown because the precise locations of these activities have not been identified. The study area for the Los Vaqueros Reservoir Alternative included enough land to account for incidental construction activities. If NRHP-eligible sites are located in the APE for incidental construction activities, significant impacts could occur.

Reservoir Operation, Land Management, and Use

Purchase of Lands. CCWD acquisition and management of lands would protect cultural resources not otherwise affected by constructing facility locations. In particular, CCWD's and EBRPD's planned purchase of the Vasco Caves site complex would result in the protection of important archeological sites and Native American values that have little formal protection under current ownership. The Vasco Caves site complex is an extremely important cultural resource with considerable importance to the archeological community and to Native Americans. The sites contain rare rock art, rock shelters, and middens. Although the Vasco Caves have been somewhat protected by limited access to the area, the rock art is deteriorating and the rock shelters and middens have been adversely affected by vandalism. Purchase of the Vasco Caves and protection of the resources will be a beneficial impact of the project. In response to Native American concerns, access to the caves will be provided to interested Native American groups, thereby preserving sites that are sacred or important to them. Limited access to, and a protection program for, the caves also will protect the archeological values present. Other sites within the watershed not directly affected by this alternative would be treated according to guidelines set forth in the Kellogg Watershed Interim Management Plan (Jones & Stokes Associates 1987b) and the cultural resources management plan that is being developed for the watershed. It is estimated that CCWD will own lands that contain approximately 60 cultural resource sites.

Reservoir Operation. All sites located near the high-water mark that could be affected by fluctuating water levels are discussed under reservoir construction impacts. Because the Los Vaqueros Reservoir Alternative would greatly reduce stream flow fluctuations, sites downstream of the dam along Kellogg Creek would not be affected.

Land Management: Grazing Practices. Although CCWD's planned reduction in grazing intensity will reduce impacts on cultural resources and, therefore, result in beneficial impacts, some archeological sites should not be subjected to grazing of any intensity because of their fragile nature.

Land Management: Fire. Controlled burning, constructing fire breaks, and clearing vegetation could destroy or damage cultural resource sites. Two historic sites, two prehistoric sites, and one site with prehistoric and historic components are located within the APE for fire management activities.

Fire prevention is the major component of CCWD's Interim Fire Management Plan (Contra Costa Water District 1989). Implementing fire management practices that do not disturb important cultural resources would result in beneficial impacts by reducing the number of historic properties potentially adversely affected by wildfires.

Land Management: Windfarm Development. The locations of windfarm development over which CCWD might have control are unknown. In locations where CCWD has control over the construction of windfarm facilities, cultural resources will be avoided.

Land Use: Recreation-Related Increased Visitation. While the conceptual recreation plan includes provisions for avoiding and protecting cultural resource sites, 11 prehistoric sites, three historic sites, and five sites with both historic and prehistoric components exist that could be adversely affected by recreation-related increased visitation.

Land Use: Research and Education. Cultural resources within the watershed offer an excellent opportunity for research and educational uses. CCWD has expressed a strong interest in cultural resources interpretive facilities in the Kellogg Creek watershed, and has sought ways to coordinate historic preservation with educational objectives. Such programs and facilities could reduce vandalism and could thereby result in beneficial impacts on historic properties.

An example of this type of beneficial impact is the planned reuse of a historic ranch complex for the Ordway Research and Conference Center. Adaptation of this complex would utilize the buildings' historic setting while ensuring that compatible architectural and historic themes are maintained.

Summary of Impacts of the Vasco Road and Utility Relocation Project. The following discussion summarizes the impacts described in the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990).

Since the Vasco Road and Utility Relocation Project EIR was completed, alignments for the road and utility relocations have been identified that greatly reduce the number of cultural resources that would be affected as compared to impacts described in the EIR. The following discussion covers only those sites within the APE for each relocated alignment.

Vasco Road Relocation: Construction Impacts. Two historic sites are located within the APE for the County Line Alignment (Modified).

Vasco Road Relocation: Secondary Impacts. Relocating Vasco Road could allow limited roadside development in areas where cultural resources are located; it is anticipated, however, that cultural resource studies will be required by Contra Costa County as specified by the Contra Costa County general plan (Contra Costa County Community Development Department 1991), and that appropriate avoidance, protection, or data recovery measures will be implemented. This impact, therefore, would be less than significant.

Electric Transmission Line Relocation. No cultural resources are located within the APE for the electronic transmission lines.

Natural Gas Pipelines Relocation. Two prehistoric sites and one historic site are located within the APE for the natural gas pipeline relocation.

Petroleum Pipelines Relocation. No cultural resources are located within the APE for the petroleum pipelines relocation.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 1 Configuration. Seventy-six cultural resource sites exist that could be affected by constructing the Rock Slough/Old River No. 1 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on them would be significant.

Rock Slough/Old River No. 2 Configuration

Facility Construction: Water Conveyance System. The impacts of the Rock Slough/Old River No. 2 configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

One site with prehistoric and historic components is located within study area for the Rock Slough/Old River No. 2 water conveyance system. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the Old River No. 2 water conveyance corridor.

The Old River No. 2 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 2 Configuration. Seventy-two cultural resources sites that could be affected by constructing the Rock Slough/Old River No. 2 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Rock Slough/Old River No. 3 Configuration

The impacts of the Rock Slough/Old River No. 3 configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

Facility Construction: Water Conveyance System. One archeological site with both prehistoric and historic components is located within the study area for the Rock Slough/ Old River No. 3 conveyance

system. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along Old River No. 3 water conveyance corridor.

The Old River No. 3 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/ Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 3 Configuration. Seventy-two cultural resource sites exist that could be affected by constructing the Rock Slough/Old River No. 3 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Rock Slough/Old River No. 4 Configuration

The impacts of the Rock Slough/Old River No. 4 configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

Facility Construction: Water Conveyance System. No known archeological sites are located within the study area for the Rock Slough/Old River No. 4 water conveyance system. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the Old River No. 4 water conveyance corridor.

The Old River No. 4 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/ Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 4 Configuration. Seventy-one cultural resources sites exist that could be affected by constructing the Rock Slough/Old River No. 4 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and impacts on these sites would be significant.

Rock Slough/Old River No. 5 Configuration

The impacts of the Rock Slough/Old River No. 5 configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

Facility Construction: Water Conveyance System. One possible prehistoric archeological site exists within the study area for the Rock Slough/Old River No. 5 water conveyance system. This potential site was discovered during geotechnical drilling and will need further work to determine whether it is an archeological deposit. An inventory of architectural properties indicated that there are six structures dating before 1945 located along the Old River No. 5 water conveyance corridor.

The Old River No. 5 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/ Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 5 Configuration. Fifty-four cultural resources sites exist that could be affected by constructing the Rock Slough/Old River No. 5 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Rock Slough/Old River No. 6 Configuration

The impacts of the Rock Slough/Old River No. 6 configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

Facility Construction: Water Conveyance System. One archeological site with prehistoric and historic components is located within the study area for the Rock Slough/Old River No. 6 water conveyance system. An inventory of architectural properties indicated that there are five structures dating before 1945 located along the Old River No. 6 water conveyance corridor.

The Old River No. 6 water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/ Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Old River No. 6 Configuration. Fifty-six cultural resources sites exist that could be affected by constructing the Rock Slough/Old River No. 6 configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Rock Slough/Clifton Court Forebay Configuration

The impacts of the Rock Slough/Clifton Court Forebay configuration are identical to those under the Rock Slough/Old River No. 1 configuration for incidental construction activities, reservoir operation, land

management and use, and Vasco Road and utility relocations, but are different for some of the water intake and conveyance facilities because of differences in location.

Facility Construction: Water Conveyance System. No known archeological sites are located within the study area for the Rock Slough/Clifton Court Forebay configuration. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the Clifton Court Forebay water conveyance corridor.

The Rock Slough/Clifton Court Forebay water conveyance corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Impacts of the Los Vaqueros pipeline are identical to those under the Rock Slough/ Old River No. 1 configuration.

Summary of Impacts and Conclusions of Significance: Rock Slough/Clifton Court Forebay Configuration. Seventy-one cultural resource sites exist that could be affected by constructing the Rock Slough/Clifton Court Forebay configuration. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this configuration. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Kellogg Reservoir Alternative

The following section discusses the impacts that could result from constructing the Kellogg Reservoir Alternative, including reservoir inundation, construction of the main dam and saddle dams, and other facilities related to the Kellogg Reservoir.

Facility Construction: Dams, Reservoir, and Related Facilities

Construction of the dams, reservoir, spillway, inlet and outlet works, transfer pipeline, related facilities and reservoir inundation would affect one prehistoric site and five historic sites.

In addition to known cultural resource sites, the reservoir, dam, and spillway area have potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities.

Facility Construction: Water Conveyance Facilities

Rock Slough/Old River No. 5 Water Conveyance Pipeline. One possible prehistoric archeological site is located within the study area for the Rock Slough/Old River No. 5 water conveyance system. The potential site was discovered during geotechnical drilling and will need additional work to determine whether it is an archeological deposit. An inventory of architectural properties indicated that there are six structures dating before 1945 located along the corridor.

The Old River No. 5 pipeline passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Los Vaqueros Pipeline. No known archeological sites exist within the study corridor for the Los Vaqueros pipeline; however, the pipeline would pass through areas with potential for buried deposits. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

An inventory of architectural properties indicated that there are six structures dating before 1945 located along the Los Vaqueros pipeline corridor.

Facility Construction: Recreation Facilities

Although a detailed conceptual recreation plan has not been developed for this alternative, for purposes of comparison, impacts on cultural resources from constructing recreation facilities are assumed to be the same as those described for the Los Vaqueros Reservoir Alternative.

Incidental Construction Activities

Impacts on cultural resources from incidental construction activities are the same as those described for the Los Vaqueros Reservoir Alternative.

Reservoir Operation, Land Management, and Use

Impacts on cultural resources from reservoir operation, land management, and use are the same as those described for the Los Vaqueros Reservoir Alternative.

Summary of Impacts of the Vasco Road and Utility Relocation Project

The following is a summary of the impacts described in the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990). Since the Vasco Road and Utility Relocation Project EIR was completed, the final alignment for the road relocation has been identified and the following discusses only those sites within the APE for that road relocation. Specific alignments within the natural gas and electrical relocation corridors for the Kellogg Reservoir Alternative have not been identified; therefore, the following site tallies include all cultural resources known within the utility relocation corridors for the Kellogg Reservoir Alternative (i.e., corridors 3, 4, 7, and 8 as described in the Vasco Road and Utility Relocation Project EIR). Under the Kellogg Reservoir Alternative, relocating the petroleum pipeline will not be necessary.

Vasco Road Relocation: Construction Impacts. Two historic sites are located within the APE for the County Line Alignment.

Vasco Road Relocation: Growth-Induced Impacts. Relocating Vasco Road could allow new development in areas where cultural resources are located; it is anticipated, however, that cultural resource studies will be required as specified by the Contra Costa County general plan (Contra Costa County Community Development Department 1991).

Natural Gas Pipeline Relocations. Portions of the natural gas pipeline relocation corridor for this alternative have not been surveyed for cultural resources. Known resources consist of two prehistoric sites, one historic site, and one site with prehistoric and historic components. A potential exists for additional sites to occur in the unsurveyed portions of the corridor.

Electrical Transmission Line Relocation. Portions of the electrical transmission line relocation corridor for this alternative have not been surveyed for cultural resources. Known cultural resources within

the corridor consist of two historic sites. A potential exists for additional sites to occur in unsurveyed portions of the corridor.

Summary of Impacts and Conclusions of Significance: Kellogg Reservoir Alternative

Eighty-four cultural resource sites exist that could be affected by constructing the Kellogg Reservoir Alternative. This total is lower than the number of sites discussed above because some sites were counted more than once when they could be affected by more than one impact mechanism. Additionally, buried archeological sites may be present within the APE for this alternative. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Desalination/EBMUD Emergency Supply Alternative

Facility Construction: Desalination Plant

One historic archeological site is located at the desalination plant site.

The desalination plant is located in an area with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Facility Construction: Brine Disposal Pipeline

No known cultural resources would be affected by constructing the brine disposal pipeline. Buried archeological sites may be present within the APE for this facility.

Facility Construction: Rock Slough Pipeline

One historic archeological site is located in the study corridor for the Rock Slough pipeline. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the Rock Slough pipeline.

The Rock Slough pipeline corridor passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground- disturbing activities associated with constructing water conveyance facilities.

Facility Construction: Electric Transmission Line

No known archeological sites exist that would be affected by constructing the electric transmission line. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the electric transmission line.

Facility Construction: EBMUD Intertie Pipeline

No known cultural resources would be affected by constructing the EBMUD intertie pipeline; however, the intertie is located in an area with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Spoil Disposal Site

Spoil disposal sites for the Desalination/EBMUD Emergency Supply Alternative have not been identified yet. Impacts from spoil disposal are unlikely because sites with known cultural resources or with potential for buried resources will not be selected.

Incidental Construction Activities

Whether cultural resources sites could be affected by incidental construction activities is unknown because the precise locations of these activities have not been identified. The study area for the Desalination/EBMUD Emergency Supply Alternative included enough land to account for incidental construction activities. If NRHP-eligible sites are located in the APE for incidental construction impacts, a significant impact could occur.

Summary of Impacts and Conclusions of Significance for the Desalination/EBMUD Emergency Supply Alternative

Constructing the Desalination/EBMUD Emergency Supply Alternative could affect 42 cultural resources sites. Additionally, buried archeological sites may be present within the APE for this alternative. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

Middle River Intake/EBMUD Emergency Supply Alternative

Facility Construction: Middle River Intake, Orwood Tract Pumping Plant, and EBMUD Intertie Pipeline

No known cultural resources exist within the APE for the intake, pumping plant, and intertie facilities; however, the area these facilities would be located in has potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Facility Construction: Middle River Pipeline

The Middle River pipeline is identical to the Old River No. 3 pipeline discussed above under the Los Vaqueros Reservoir Alternative, except that it extends 1.5 miles further east. One archeological site with both prehistoric and historic components is located within the study area for the Rock Slough/Old River No. 3 conveyance system and one historic archeological site is located at the Middle River intake site. A preliminary inventory of architectural properties indicated that approximately 20 structures dating before 1945 are located along the corridor.

The Middle River pipeline passes through areas with potential for buried archeological sites. If buried sites are present, they could be adversely affected by ground-disturbing activities associated with constructing water conveyance facilities.

Spoil Disposal Site

Impacts are the same as those described under the Desalination/EBMUD Emergency Supply Alternative.

Incidental Construction Activities

Impacts are the same as those described under the Desalination/EBMUD Emergency Supply Alternative.

Summary of Impacts and Conclusions of Significance for the Middle River/EBMUD Emergency Supply Alternative

Constructing the Middle River Intake/EBMUD Emergency Supply Alternative could affect 21 cultural resources. Additionally, buried archeological sites may be present within the APE for this alternative. Until these sites are evaluated for their NRHP eligibility, all sites are assumed to be potentially eligible and any impacts on these sites would be significant.

MITIGATION MEASURES

As impact areas for the preferred alternative are further refined, each site potentially affected by the preferred alternative will be assessed to determine the appropriate method of mitigation or avoidance. The preferred measure is site avoidance. If avoidance is not prudent or feasible, other site protection and preservation measures would apply. If those are also infeasible or could not ensure protection of sensitive cultural resources, then evaluation, testing, and data recovery, if appropriate, could be necessary. Involvement of appropriate Native American groups will be solicited during the mitigation decision-making process.

Mitigation Measures Common to All Alternatives

Site Avoidance Measures

11-1: Avoid Cultural Resource Sites. Avoidance of cultural resources is the preferred mitigation measure. Adequate avoidance requires that the qualities that might make properties eligible for the NRHP be considered. For example, prehistoric or historic archeological sites can be avoided by restricting ground-disturbing activities in the vicinity of the site. Avoidance of resources with settings that might contribute to their NRHP eligibility might also include restricting permanent visual or audible elements that are out of character with the setting of the property.

Once the locations of access points, staging areas, and other construction-related activities are determined, measures to protect sites in the vicinity of each activity should be established and implemented. The preferred method of avoiding impacts is to relocate construction-related activities to avoid cultural

resources. Fencing and monitoring to ensure that sites are protected might also be necessary and are described below.

Potentially eligible sites that cannot be avoided must be included in the Section 106 review process. The goal of this five-step process is to avoid, minimize, or reduce impacts on important cultural resources. The five steps are:

- identify and evaluate historic properties;
- assess the effects of the undertaking on properties that are eligible for the NRHP;
- consult with OHP and other agencies for the development of an MOA that addresses the treatment of historic properties;
- receive Advisory Council on Historic Preservation comments on the MOA or results of consultation; and
- implement the project according to the conditions of the MOA.

Resources within the APE for the preferred alternative have been identified and are being evaluated for their NRHP eligibility. After evaluation, specific measures to avoid, minimize, or reduce impacts on NRHP-eligible properties will be developed in consultation with OHP in accordance with Section 106 of the National Historic Preservation Act and related implementing procedures. A programmatic agreement between OHP, Reclamation, CCWD, and the Advisory Council on Historic Preservation is being prepared that outlines how and when Section 106 compliance will occur and what mitigation measures will be implemented. The mitigation measures presented below are generally stated, pending the completion of the evaluation of resources within the APE for the NRHP.

Recommended Site Preservation and Protection Measures

11-2: Prevent Ground-Disturbing Activities Near Sites. When construction-related activities are planned near sites but not within the APE for construction, ground disturbance should be prohibited within 100 feet of the site or an appropriate distance as determined by a qualified archeologist familiar with the project area. A monitoring plan should be prepared and implemented that includes guidelines for monitoring sites located near the APE that could be affected by construction-related activities.

11-3: Prevent Access to Historic Properties. Fencing or other barriers may need to be placed near sites that could attract construction crews to prevent construction-related impacts. A monitoring plan should be prepared and implemented to ensure that fencing adequately protects sites from incidental construction activities.

11-4: Assess APE for Sensitivity of Buried Resources and Monitor Areas during Ground-Disturbing Activities. Areas along Kellogg Creek and the water conveyance alignments could contain buried cultural resources. Although no surface materials have been found in these locations, sites have been found in nearby areas within similar physiographic settings under several feet of alluvial material. A monitoring plan should be prepared outlining the areas along Kellogg Creek and the water conveyance alignment that should be monitored during construction. If buried sites are found, they will need to be considered as part of the Section 106 review process.

11-5: Design Project Facilities to Be Unobtrusive. Where preserved historic properties are within the APE of an above-ground facility, the facility should be designed to be architecturally compatible with

historic properties and should be designed to blend visually with the surrounding area. Where appropriate, landscaping should be used to screen facilities from historic properties and to avoid or reduce visual impacts.

11-6: Consult with Native American Groups. The project region contains sites that have traditional religious or cultural values to Native Americans. These values are specifically protected under Section 106 of the NHPA. An agreement between concerned Native Americans and CCWD has been initiated. Specific mitigation measures for impacts on areas of Native American concern have not yet been developed; however, purchase and protection of important Native American sites, like Vasco Caves, is proposed. Native American input into the management and control of access to the caves would be sought.

In some cases, mitigating impacts on sacred areas to a less-than-significant level may be impossible. For example, archeological sites containing human remains are valuable for their cultural and religious meaning and their scientific value; therefore, if Native Americans concerns are not met, data recovery may be inadequate to reduce the impact to a less-than-significant level. Conversely, if sites containing human remains can be protected without disturbance, knowledge of the site's scientific values would be foregone. However, in some cases impacts could be reduced to a less-than-significant level by relocating human remains to another site in a manner approved by the concerned Native Americans.

Site Evaluation and Data Recovery Measures

11-7: Evaluate Sites and Conduct Data Recovery for NRHP-Eligible Properties. Sites that cannot be avoided or protected should be evaluated for their eligibility for listing in the NRHP. A data recovery plan that outlines how the data would be recovered, and how sites likely to contain human remains are to be treated, and should be prepared as a basis for consultation with Native American Groups for ultimate approval by OHP. Data recovery plans should be consistent with guidelines set forth in the Secretary of the Interior's standards and guidelines for archeological documentation.

Data recovery should also be undertaken for standing buildings or structures that are eligible for the NRHP only for the information they contain. For these resources, data recovery involves documentation of the property according to the standards of the Historic American Building Survey or the Historic American Engineering Record and any historic research necessary to fully document the property.

Data recovery findings should be documented in a data recovery report. Data recovery reports would follow guidelines set forth by OHP for archeological resources management reports.

Additional Mitigation Measures Specific to the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Impacts Caused by Adaptive Reuse of Historic Properties

11-8: Design Reuse of Historic Properties to Preserve Important Characteristics. The conceptual recreation plan includes the reuse of some structures that are potentially eligible for the NRHP. If the buildings are determined eligible for the NRHP, reuse and development of historic properties for research, education, or recreational purposes should use the following guidelines set forth by the secretary of interior (1983) for the rehabilitation of historic buildings, including:

1. Every reasonable effort shall be made to provide a compatible use for a property which requires minimal alteration of the building, structure, or site and its environment, and to use a property for its originally intended purpose.

2. The distinguishing original qualities or character of a building, structure, or site and its environment shall not be destroyed. The removal or alteration of any historic material or distinctive architectural features should be avoided when possible.

3. All buildings, structures, and sites shall be recognized as products of their own time. Alterations that have no historical basis and which seek to create an earlier appearance shall be discouraged.

4. Changes which may have taken place in the course of time are evidence of the history and development of a building, structure, or site and its environment. These changes may have acquired significance in their own right, and this significance shall be recognized and respected.

5. Distinctive stylistic features or examples of it craftsmanship which characterize a building, structure, or site shall be treated with sensitivity.

6. Deteriorated architectural features shall be repaired rather than replaced whenever possible. In the event replacement is necessary, the new material should match the material being replaced in composition, design, color, texture, and other visual qualities. Repair or replacement of missing architectural features should be based on accurate duplications of features, substantiated by historic, physical, or pictorial evidence rather than on conjectural designs or the availability of different architectural elements from other buildings or structures.

7. The surface cleaning of structures should be undertaken with the gentlest means possible. Sandblasting and other cleaning methods that will damage the historic building materials shall not be undertaken.

8. Every reasonable effort shall be made to protect and preserve archeological resources affected by, or adjacent to, any project.

9. Contemporary design for alterations and additions to existing properties shall not be discouraged when such alterations and additions do not destroy significant historical, architectural, or cultural material, and such design is compatible in size, scale, color, material, and character of the property, neighborhood, and environment.

10. Whenever possible, new additions or alterations to structures shall be done in such a manner that if such additions and alterations where removed in the future, the essential form and integrity of the structure would be unimpaired.

Impacts on Cultural Resources from Long-Term Management Practices

11-9: Prepare and Implement Cultural Resources Management Plan for the Kellogg Creek Watershed. Impacts on some sites from increased access and vandalism can be prevented by implementing a cultural resources management plan. The plan would include restrictions for use in areas of sensitivity (e.g., restrict use near NRHP-eligible properties and provide a monitoring program to ensure that NRHP-eligible properties are protected).

In some cases, preserving archeological and historical sites in place may be possible. To ensure the long-term protection of these sites, the plan would provide guidelines to prevent impacts on cultural resources, such as restrictions for use in areas of sensitivity, a long-term monitoring program to ensure that NRHP-eligible properties are protected in the future.

Additional Mitigation Measures Specific to the Kellogg Reservoir Alternative

Potential Impacts on Cultural Resources within Unsurveyed Portions of the Project Area

11-10: Conduct Surveys for Unsurveyed Portions of the Project Area. Small areas within the utility relocation corridors for the Kellogg Reservoir Alternative have not been surveyed. If this alternative is selected, these areas should be surveyed for cultural resources. If cultural resources are found, they should be included in the Section 106 compliance process.

Chapter 12. Human Environment

AFFECTED ENVIRONMENT

Land Use

The Contra Costa County General Plan (Contra Costa County Community Development Department 1991) identifies three distinct geographic areas in the county: west county, central county, and east county. The east county region, which comprises the largest land area, is further divided into the subareas of Pittsburg-Antioch and other east county. All facilities associated with the alternatives considered in this EIR/EIS are located in the east county region.

With the exception of a small section of the County Line Alignment (Modified), no project-related facilities would be located in Alameda County; therefore, no land use impacts would occur. For this reason, land use considerations in Alameda County are not discussed in this section. Other considerations involving Alameda County are discussed below as appropriate.

Existing and Planned Land Uses

Land uses are described in this section generally for east county and more specifically for locations that could be directly affected by implementation of the project alternatives. Land uses and planned developments in the Kellogg Creek watershed and east of the watershed are discussed in detail because these portions of east county encompass the major components of the reservoir alternatives. Land uses near the other alternative sites are discussed generally with particular attention to nearby sensitive land uses.

East Contra Costa County. Existing and planned land uses in east county are described in the recently adopted Contra Costa County general plan. Land use information for the project area has been excerpted from this document and is presented below.

East county is predominantly rural, consisting of sparsely populated agricultural and open space lands interspersed with scattered ranches, farms, light industrial uses, rural residences, and small residential communities. Brentwood is the only incorporated city in the rural east county region and consists primarily of residential, commercial, and agriculture-oriented industrial uses. The Cities of Antioch and Pittsburg could also be affected by nonreservoir project alternatives. Other east county urban and suburban communities include Oakley, Knightsen, Byron, Discovery Bay, and Bethel Island. Generalized project area land uses are shown in Figure 12-1.

Kellogg Creek Watershed. The Kellogg Creek watershed is used for cattle grazing, dryland farming, rural residential homes, windfarming, and wildlife habitat. Regional recreation open space lands are immediately adjacent to the watershed's western boundary.

Agriculture. Cattle grazing is the predominant land use in the vicinity of the Kellogg Creek watershed. Cattle farms range in size from about 160 acres to more than 5,000 acres. The largest cattle operations in the watershed are the Vaquero Farms and Ordway Ranch.

Dryland farming is a minor agricultural use of the watershed. Dryland farmers grow crops without irrigation, depending on rainfall. Approximately 2,300 acres of land within the watershed are dryland farmed for production of grain and hay crops.

Land in Contra Costa and Alameda Counties is designated as agricultural preserve under the California Land Conservation Act of 1965 (Williamson Act). Approximately 2,500 acres of Contra Costa County and 979 acres of Alameda County lands within the watershed are under Williamson Act contracts.

Rural Residences. Thirty-three residential units exist in the Kellogg Creek watershed, housing an estimated population of 87. Three units are in Alameda County and 30 are in Contra Costa County. Of these residential units, 24 are located along Morgan Territory Road at the western edge of the watershed and would not be purchased by CCWD. CCWD may acquire development rights to these parcels, however, to prevent further subdivision and land uses that could threaten reservoir water quality. Three other units are located at the southern end of the watershed.

As of January 1992, eight residential units were located in the Kellogg Reservoir and Los Vaqueros Reservoir inundation areas. CCWD has already purchased several of the properties and proposes to acquire the remaining units. These actions were analyzed as part of the Stage 1 EIR for the Los Vaqueros/Kellogg Project.

Windfarming. Windfarming operations (wind energy conversion systems) occur throughout much of southeastern Contra Costa County and in the Altamont Hills in Alameda County. Windfarms are operated on private land through wind easement agreements with landowners. Land use permits are required for wind energy generation in Contra Costa and Alameda Counties. Several companies operate nearly 500 wind turbines on over 1,800 acres of watershed land. Approximately 3,300 acres of the watershed are permitted for windfarming. Figure 12-1 shows the general locations of windfarms and areas that are permitted for future windfarm development.

Regional Recreation Lands. The western watershed boundary is adjacent to EBRPD's Morgan Territory Regional Preserve and Round Valley Preserve (Figure 12-1). Activities in the Morgan Territory Regional Preserve include open space activities such as hiking, bicycling, horseback riding, picnicking, and other nature-oriented recreation. Round Valley Regional Preserve is not open to the public. Recreation resources are discussed later in this chapter.

Los Vaqueros Pipeline Alignment. The primary land use near the Los Vaqueros pipeline alignment is dryland pasture, although various agricultural crops, such as apples, sugar beets, tomatoes, walnuts, alfalfa, cherries, grain and hay are also grown.

Other land uses near the alignment include gas wells, irrigation canals, electric transmission line easements, and rural residences.

Old River and Clifton Court Forebay Pipeline Alignments and Intake Sites. The primary land uses near the Old River and Clifton Court Forebay pipeline alignments are agricultural. Past uses of the sites have been for cultivation of row crops, including asparagus, tomatoes, squash, sugar beets, and corn. Tree crops include apples, apricots, cherries, walnuts, and pears. Much of the Old River No. 1 and Clifton Court Forebay pipelines would also cross grazing land.

Other uses near alignments include water conveyance systems for both agricultural and utility purposes, electric transmission lines and related facilities, and rural residential uses.

All the Old River intake sites are cultivated for row crops such as asparagus and corn. A portion of the Old River No. 5 intake site is not cultivated but is used as equipment storage for nearby agricultural product processing facilities. Land uses near the Old River No. 3 intake site also include water conveyance

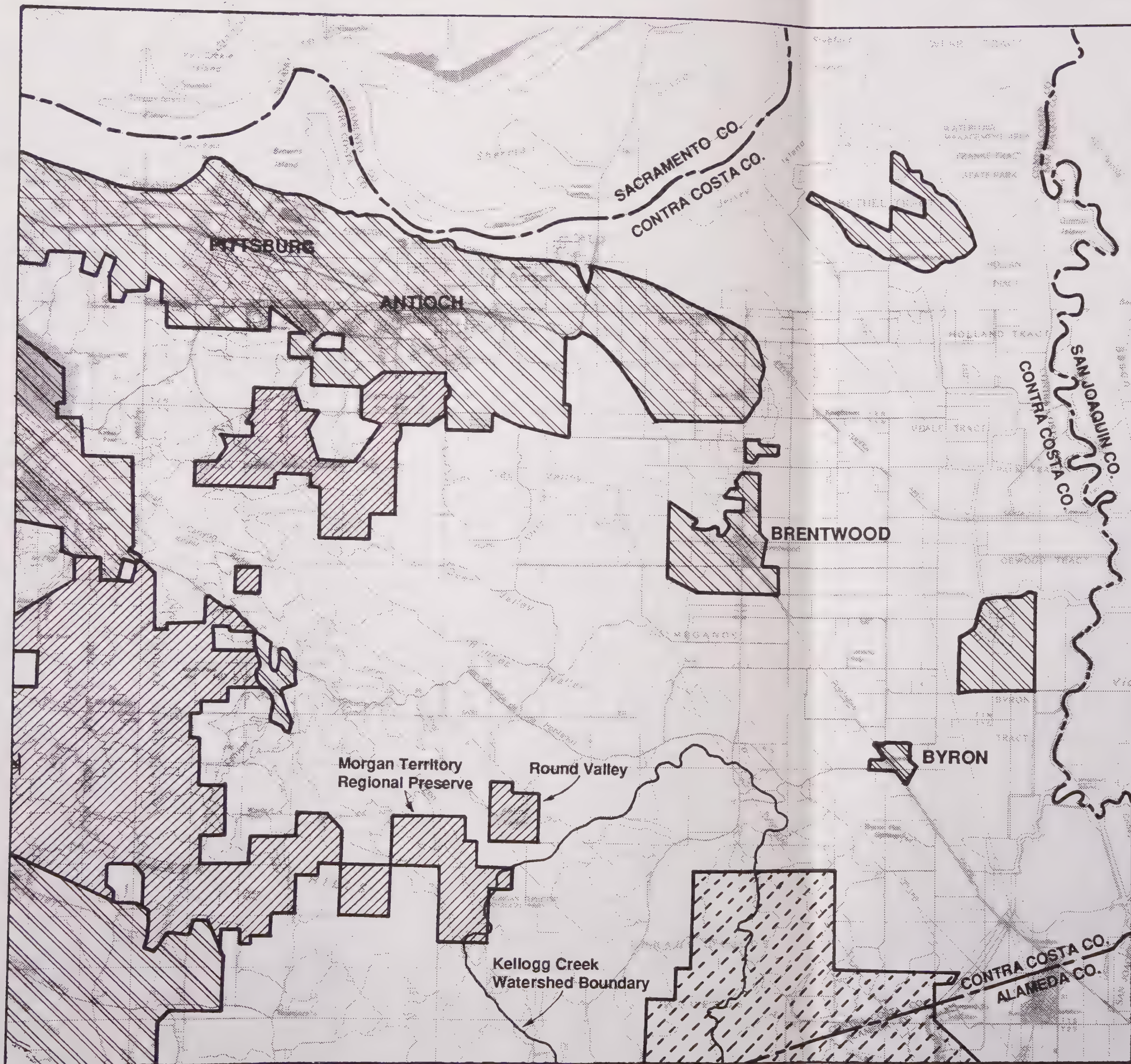


Figure 12-1.
Selected Generalized Land Uses of Eastern Contra Costa County

LEGEND

- Major parks and nonagricultural open space areas
- Urban and suburban areas
- Permitted windfarm and associated agricultural areas
- Agricultural areas, water, and other miscellaneous land uses
- Contra Costa County boundary

facilities and several marinas on Old River. The Clifton Court Forebay intake site includes idle agricultural lands, native vegetation, and light industrial uses.

Transfer Reservoir Sites. All the transfer reservoirs would be located on grazing land. Land uses near the PG&E Hill transfer reservoir site include irrigation canals, orchards, pasture land, and transmission lines. Land uses near the Camino Diablo transfer reservoir site include the Unimin Corporation's sand quarrying operations and pasture lands. The Kellogg transfer reservoir site is located near pasture lands and ranching complexes.

Desalination Plant and Pipeline Facilities. The desalination plant site is fallow land occupied by one rural residence. Lands surrounding the site are either fallow or are farmed for row crops. Land uses near the Rock Slough pipeline alignment are agriculture, residential, water conveyance facilities, and open space. Except for a short length of the brine disposal pipeline that crosses an orchard just west of the desalination plant site and the portion of the alignment from Willow Pass Road to Stake Point, this pipeline would be sited within existing street rights-of-way. The alignment would traverse rural and urban areas north of SR 4 through Antioch and Pittsburg.

Middle River Pipeline and Intake Sites. Land uses near the Middle River pipeline include agriculture (hay and row crops), rural residences, light industrial uses, a railroad right-of-way, and water conveyance facilities. A portion of the alignment crosses annual grasslands. The Middle River intake site is currently cultivated for various crops.

Relevant Proposed Development Projects

Relevant development projects that are proposed to be located near the project facilities are discussed for each of the project alternatives below in the "Environmental Consequences" section.

Relevant Contra Costa County General Plan and Zoning Designations

Relevant general plan and zoning designations are discussed below for the project area in east county. This section identifies the current Contra Costa County land use designations and zoning that regulate uses in areas that would be affected by implementation of the project alternatives.

General Plan Designations. Table 12-1 lists and summarizes a description of Contra Costa County's general plan land use designations. Most project alternative facilities would be located in rural county areas designated for agricultural or open space uses. Other project alternative facilities would be located in Antioch and Pittsburg along roadway corridors that bisect many residential, commercial, and industrial land use designations. This discussion identifies land use designations that would be affected by facilities in the unincorporated portion of the county. City land use designations that may be affected by project alternative pipelines are discussed in the "Environmental Consequences" section.

Major project alternative facilities that could be constructed on unincorporated county lands would be located on lands designated by Contra Costa County as Agricultural Lands (AL), Agricultural Core (AC), Public-Semi-Public (PS), Delta Recreation and Resources (DR), Watershed (WS), and Light Industrial (LI). The descriptions of the designation below have been excerpted from the Contra Costa County general plan.

Agricultural Land. The AL designation encompasses most of the privately owned rural lands in the east county region. The primary purpose of this designation is to preserve and protect lands well suited for the production of food, fiber, and plant materials. The general plan states that this designation should not be used to exclude or limit other types of agricultural, open space, or nonurban uses, such as landfills. No limitations for water conveyance and storage facilities are identified.

Table 12-1. Summary of Contra Costa County General Plan Land Use Designation

Designation	Land Use Map Abbreviation	Units per Net Acre[a]	Floor Area Ratio[b]
Single-Family Residential			
Very low	SV	0.2-0.9	
Low	SL	1.0-2.9	
Medium	SM	3.0-4.9	
High	SH	5.0-7.2	
Multiple-Family Residential			
Low	ML	7.3-11.9	
Medium	MM	12.0-20.9	
High	MH	21.0-29.9	
Very high	MV	30.0-44.9	
Very high-special	MS	45.0-99.9	
Congregate care-senior housing	CC	NA	
Mobile home	MO	1.0-12.0	
Commercial/Industrial			
Regional commercial	RC		(subject to city plans)
Commercial	CO		0.1-1.0
Airport commercial	ACC		.1-1.5
Office	OF		0.1-1.5
Business park	BP		0.25-1.5
Light industrial	LI		0.25-0.67
Heavy Industry	HI		0.1-0.4
Commercial recreation	CR		0.1-1.0
Mixed use (M1, M2, M3, etc.)	M1 etc.		varies (see text)
Local commercial	LC		varies (see text)
Marina commercial	MC		varies (see text)
Other			
Parks and recreations	PR		0.2
Open space	OS		
Agricultural lands	AL		0.2
Agricultural core	AC		0.025
Delta recreation	DR		0.05
Water	WA		
Watershed	WS		

[a] Net acreage includes all land area used exclusively for residential purposes, and excludes streets, highways, and all other public right-of-way. Net acreage is assumed to constitute 75% of gross acreage for all uses, except for the Multiple Family designations, where it is assumed to comprise 80%.

[b] Floor area ratio is calculated by dividing building square footage by lot size.

Source: Contra Costa County Community Development Department 1991.

Agricultural Core. The AC designation is applied to agricultural lands composed primarily of prime (Class I or II) soils in the SCS Land Use Capability Classifications that are considered the most valuable for farming a wide variety of crops. A portion of the AC-designated lands are located in the 100-year floodplain, as identified by FEMA.

The purpose of the designation is to preserve and protect the most desirable farming lands in the county and to maintain economically viable, commercial agricultural units. Land use controls under the AC designation are stricter than under the AL designation, and minor subdivisions and "ranchette" housing developments are discouraged.

The AC designation also generally discourages placing public roadways or new utility corridors in areas that would adversely affect the viability of the Agricultural Core if economically feasible alternatives exist (Contra Costa County Community Development Department 1991).

Public-Semi-Public. The PS designation includes properties owned by public governmental agencies such as libraries, fire stations, and schools and also is applied to public and privately owned transportation corridors, such as railroads, electric transmission lines, and pipelines. A wide variety of public and private uses are allowed on PS-designated lands. Private residences, private commercial uses, and subdividing land are not considered compatible with this designation.

Delta Recreation and Resources. The DR designation encompasses the islands and adjacent lowlands of the Delta, excluding Bethel Island and Discovery Bay. Most of these lands are within the Delta's 100-year floodplain. Flood hazards preclude intensive residential, commercial, or industrial development in these areas.

The allowable uses on lands designated DR are primarily agricultural. Other uses allowed with a land use permit include marinas, shooting ranges, duck and other hunting clubs, campgrounds, and other outdoor moderate-intensity recreational facilities. Uses that would draw large numbers of people to the area or that require urban services are generally not allowed in DR-designated areas.

Watershed. The WS designation is applied to lands associated with reservoirs used for domestic water supply. The designation limits uses to those that would not degrade reservoir water quality. These uses include agricultural practices such as grazing or dryland farming that do not depend on fertilizers or pesticides; low-intensity, passive recreational uses such as hiking, horseback riding, and biking; and small-scale commercial uses that support recreation activities. Lands with this designation are owned by public agencies.

Light Industrial. The LI designation allows light industrial activities such as processing, packaging, machinery repair, fabrication, distribution activities, warehousing and storage, research and development, and similar uses that produce minor amounts of smoke, noise, light, or pollutants.

Relevant General Plan Goals and Policies

The Contra Costa general plan contains goals, policies, and implementation measures that, together with land use designations and the zoning code, are designed to guide land use and resource planning and development over the next 15 years. The general plan policies encourage protecting agricultural land and mineral resources, vegetation and wildlife habitats, natural waterways, visual resources, and cultural resources and wind resources. The general plan also includes several land use policies for the east county area, Oakley-North Brentwood area, and southeast county area that are intended to guide the county's land use priorities in urban and rural areas. The goals and policies that are relevant to the project alternatives are summarized and analyzed below in the "Environmental Consequences" section.

Urban Limit Line

On November 6, 1990, Contra Costa County voters approved a land preservation ordinance, also known as the 65/35 plan, which was designed by the county board of supervisors. The main purpose of the ordinance is to restrict urban development to 35% of the total land in Contra Costa County and to preserve the remaining 65% for nonurban uses such as agriculture, open space, wetlands, and parks. The ordinance policies are intended to:

- create an urban limit line (ULL) to identify the outer boundaries of urban development),
- maintain the 65/35 plan standard except if changed by a vote of the people,
- allow changes to the ULL configuration only by a four-fifths vote of the board of supervisors, and
- protect open hillsides and significant ridgelines throughout the county from development by zoning and other measures (Contra Costa County Community Development Department 1991).

Although limited development that is consistent with rural uses and existing zoning can occur on properties located outside the ULL, these areas cannot be considered for general plan amendments that would redesignate them for urban uses. In addition, development of properties inside the ULL designated in the general plan for open space uses would require a general plan amendment. Thus, rural properties within the ULL will not necessarily convert to urban uses; the 65/35 plan guarantees that urban development cannot extend beyond the ULL (Contra Costa County Community Development Department 1991).

Recreation

Introduction

This section describes recreation resources in a regional and project area context. The regional area is defined as Contra Costa County and northeastern Alameda County. The project area is defined as the area in which any of the alternative storage, conveyance, and treatment facilities would be located.

Recreation resources analyzed in this chapter include regional parks, reserves, and trails and private facilities that provide services to users of public recreation areas. Because several recreation sites and facilities are located in Contra Costa County, a detailed description of recreation resources is limited to the project area.

Project Area Recreation Resources

Most outdoor recreation in Contra Costa County occurs at facilities operated by the California Department of Parks and Recreation (DPR), EBRPD, and EBMUD. In addition, the Livermore Area Recreation and Park District (LARPD) provides facilities in the eastern portion of Alameda County that are not within the boundaries of the EBRPD. Parks and associated facilities provided by LARPD are located south of the Kellogg Creek watershed in Alameda County.

Demand for recreation facilities in Contra Costa County will increase in proportion to the growth in regional population. The region's population is one of the fastest growing in California and is expected to reach 5.4 million by 2005. This would represent an increase of 16% over the 1988 level. Recreation demand in Contra Costa County in 1985 was 19.9 million user-days; this number is projected to increase to 23.6 million user-days by 2000. Water-associated recreation is projected to total over 2.8 million user-days in

2000. Water-associated recreation includes sunning, fishing, boating, and swimming. (Jones & Stokes Associates 1991d.)

Table 12-2 lists recreation facilities in the project area, recreation facility acreages, and the number of user-days in 1989. Table 12-3 lists recreation facilities proposed for the project area by EBRPD and LARPD. Three regional multiuse trails are located in the project area: the Black Diamond/Mt. Diablo Trail, Contra Costa Canal Trail, and Los Trampas/Mt. Diablo Trail. Eight trails are proposed for the project area by EBRPD, and Contra Costa County has proposed approximately 20 trails for the project area.

Recreation opportunities in the Kellogg Creek watershed are limited. These lands are either under the ownership of private parties, CCWD, or EBRPD. Recreation opportunities in the watershed are limited because public access is typically not allowed on private lands, and CCWD's current watershed management policy does not include provisions for public access to district lands.

Plans and Policies

Local plans and policies have recognized the importance of recreation in the project area as well as in the region. These plans include those developed by Contra Costa County, EBRPD, and LARPD.

Contra Costa County General Plan. Contra Costa County has formulated several goals and policies that recognize the importance of recreation opportunities to the county's residents. Contra Costa County general plan goals include providing sufficient park and recreational facilities for all county residents, developing connected regional trail systems, and promoting active and passive recreational enjoyment of the county's physical amenities. Implementation measures include encouraging intergovernmental coordination for the optimal use of recreation facilities and developing comprehensive and interconnected recreation trails (Contra Costa County Community Development Department 1990).

East Bay Regional Park District. The primary goal of EBRPD is to create an equitable distribution of regional parkland that meets the needs and desires of district residents (East Bay Regional Park District 1988). To implement the primary goal of providing equitable recreation opportunities to district residents, the district has developed policies that address resource, recreation, education, planning, and operation concerns.

Livermore Area Recreation and Park District. LARPD is responsible for the regional parks, natural open space, and trails in the eastern Alameda County region. The primary goals of LARPD are to develop facilities to meet present and future needs, preserve open space and natural areas, acquire and develop regional parkland, and establish a network of connected trails and bikeways (Livermore Area Recreation and Park District 1989).

Population, Employment, and Housing

This section provides a general description of existing population, housing, and employment conditions in the project region and communities in the east county region.

Population Rate of Growth

The east county region's current population of approximately 164,000 is concentrated in the Pittsburg-Antioch area. The other east county communities of Oakley, Byron, Sand Hill, Knightsen, Bethel Island, Discovery Bay, and Brentwood have less than 45,000 residents in all. (Contra Costa County Community Development Department 1991.) These communities have undergone significant growth,

Table 12-2. Selected Parks, Reserves, and Shorelines in the Project Area

Administrating Agency	Name	Type[a]	Acres	User-Days (1989)	Uses
East Bay Regional Park District	Antioch Shoreline	RS	7	48,000	Fishing, picnicking
	Black Diamond Mines	RPS	3,649	100,000	Interpretive, historic, picnicking
	Browns Island	RS	595	NA	Fishing, birding
	Contra Loma	RP	776	500,000	Swimming
	Diablo Foothills/Castle Rock	RP	977	25,000	Swimming, hiking, vistas
	Morgan Territory	RP	3,469	5,000	Hiking, riding, vistas
	Round Valley	RP	NA	NA	Public access restricted
	Tassajara Creek	RP	451	2,000	Hiking, riding
California Department of Parks and Recreation	Mount Diablo	SP	18,758	648,630	Picnicking, camping, hiking, riding, vistas
	Franks Tract	SRA	3,532	21,018	Boating, fishing
Total			32,214	1,349,648	

Notes: Use data are not available for Round Valley or Browns Island.

NA = not available.

[a] Park types:
- RS = regional shoreline.
- RP = regional park.
- RPS = regional preserve.
- SP = state park.
- SRA = state recreation area.

Sources: East Bay Regional Park District 1989, California Department of Finance 1990, Erba pers. comm.

Table 12-3. Proposed Recreation Facilities in the Project Area

Administrating Agency	Name	Use
East Bay Regional Park District	Pittsburg Antioch Shoreline	Delta shoreline access in Antioch area
	Delta Recreation	Delta access east of Brentwood
Livermore Area Recreation and Park District	Brushy Peak	Provision of vistas

Sources: East Bay Regional Park District 1989, Livermore Area Recreation and Park District 1989.

however. For instance, the population of Brentwood increased by 2,616, from 4,434 in 1980 to 7,050 in 1990, an increase of 58.9% or more than 2.5 times the countywide average (Table 12-4) (California Employment Development Department 1990). The population of the unincorporated rural east county area, which includes the communities of Oakley, Sand Hill, Knightsen, and Byron, grew from 14,056 in 1980 to 24,600 in 1990, an increase of 10,544 or 75% (Association of Bay Area Governments 1989).

Population Growth Projections

According to ABAG (1989) the county's population is expected to rise by about 86,000 between 1995 and 2005. Most of this growth will be concentrated in the east and central county regions.

The east county region is projected to undergo substantial change from an unpopulated rural, agricultural area to a more suburban region (California Employment Development Department 1990). According to projections for 1990-2005 by ABAG (1989), about 54% of the county's new employed residents will live in the east and west county regions. The Contra Costa County general plan projects a population growth of about 65,000 in the unincorporated rural east county communities of Oakley, Bethel Island, and Discovery Bay and in the City of Brentwood resulting from the planned construction of about 29,000 new homes (Contra Costa County Community Development Department 1991). ABAG projections (1989) for 2005 show an expected population of 28,400 in Brentwood and 42,000 in the unincorporated rural east county region, a combined increase of more than 107% over the next 15 years.

Rate of Housing Growth

According to the general plan, 62,805 units of new housing were built in Contra Costa County during the last decade. The amount of housing in the county increased 24.9%, from 251,918 units in 1980 to 314,723 units in 1990 (Table 12-5). The amount of housing in the east county region has increased quickly, rising from 41,338 units in 1980 to 61,020 units in 1990, a growth of 47.6%. (Contra Costa County Community Development Department 1991.)

Housing Growth Projections

According to ABAG, Contra Costa County is expected to add about 77,000 new households between 1990 and 2005. Construction of approximately 29,000 new homes is projected in the east county communities of Oakley, Bethel Island, Discovery Bay, and Brentwood. The number of residential units currently in the planning process is unavailable; however, the projection of 29,000 is considered a conservative estimate of potential residential construction (Cutler pers. comm.). The county general plan indicates that substantial growth will occur in the Oakley area south of Laurel Road within the City of Brentwood sphere of influence (SOI). (Contra Costa County Community Development Department 1991.)

Rate of Employment Growth

Table 12-6 presents countywide employment growth by industrial sector between 1980 and 1990.

According to the ABAG (1989), in the last decade, overall employment increased by approximately 50% in Antioch, 59% in Pittsburg, 105% in Brentwood, and 38% in the unincorporated rural east county region. These figures generally compare favorably to the countywide employment growth of 45.6% for the last decade. Most of this growth has been in services and retail trade.

Table 12-4. Population, Housing, and Employment
Summary for Contra Costa County
(1980-1990)

	1980	1990	Increase Number	Increase %
Population	656,380	802,933	146,553	22.3
Housing units	251,918	314,723	62,805	24.9
Jobs	201,237	292,700	91,463	45.4

Source: Contra Costa County Community Development Department 1991.

Table 12-5. Growth in Residential Housing in Contra Costa County (1980-1990)

County Region	Housing Units (1980)	Housing Units (1990)	Growth in Housing (1980-1990)	Growth (% Increase)
East	41,338	61,020	19,682	47.6
Central	138,745	168,995	30,250	21.8
West	71,835	84,708	12,873	17.9
Total	251,918	314,723	62,805	24.9

Source: Contra Costa County Community Development Department 1991.

Table 12-6. Employment Growth by Sector in Contra Costa County (1980-1990)

Employment Sector	1980	1990	Increase Number	Increase %
Agriculture/mining	3,567	4,920	1,353	37.9
Construction	14,929	23,380	8,451	56.6
Finance, insurance, real estate	17,017	32,170	15,153	89.0
Government	16,887	18,190	1,303	7.7
Manufacturing	27,148	29,250	2,102	7.7
Retail trade	44,297	60,160	15,863	35.8
Services	59,844	86,420	26,576	44.4
Transportation/communication/utilities	10,918	28,350	17,432	159.7
Wholesale trade	6,630	9,860	3,230	48.7
Total	201,237	292,700	91,463	45.6

Source: Association of Bay Area Governments 1989.

Employment Growth Projections

According to ABAG, the projected job growth of 97,000 new jobs is expected to be exceeded by the projected increase of 105,000 in the labor supply (Association of Bay Area Governments 1989). Table 12-7 presents projected countywide employment growth by job sector between 1990 and 2005. During the same period in east county, employment in the services industry is projected to increase by 210% in the unincorporated rural east county region and by 66% in Brentwood. Retail employment is expected to increase by 181% in the unincorporated rural east county region and by 180% in Brentwood during the same period. The projected additional 2,310 new jobs would make retail trade the largest growth sector in the east county region's economy. (Association of Bay Area Governments 1989.)

ENVIRONMENTAL CONSEQUENCES

Land Use

Criteria for Conclusions of Significance

Land use impacts are considered significant if implementation of an alternative would:

- result in conversion of agricultural land producing more than 1% of the total value of crops produced in Contra Costa County;
- require removal or relocation of structures or facilities used for residential, commercial, or industrial purposes;
- result in permanent conflicts with adjacent land uses;
- result in conflicts with planned developments for which applications have been filed with an appropriate jurisdiction;
- result in construction nuisances on sensitive land uses over an extended period; or
- result in clear inconsistencies with adopted Contra Costa County general plan policies and land use designations.

County planning staff members have indicated that water conveyance pipelines are not regulated by Contra Costa County's zoning ordinance (Beard pers. comm.). For this reason, and because Section 53091 and 53096 of the California Government Code exempts public water supply facilities from regulation under local zoning ordinances, apparent inconsistencies with county zoning designations have not been evaluated.

No-Action Alternative

Construction Impacts of Contra Costa Canal and Pumping Plant Expansion. Implementation of future Contra Costa Canal and pumping plant expansions would result in direct modification of the canal within the existing right-of-way. No land use changes would occur outside the canal right-of-way; therefore, no direct land conversion impacts would result.

Expansion of the Contra Costa Canal and pumping plants could potentially subject rural residences and other sensitive land uses to construction-related nuisances. Because these potential construction effects

Table 12-7. Projected Employment Growth by Sector in Contra Costa County (1990-2005)

Employment Sector	1990	2005	Increase Number	Increase %
Agriculture/mining	4,920	5,120	200	4.0
Construction	23,380	35,980	12,600	53.9
Finance, insurance, real estate	32,170	39,430	7,260	22.6
Government	18,190	19,510	1,320	7.3
Manufacturing	29,250	40,020	10,770	36.8
Retail trade	60,160	82,340	22,180	36.8
Services	86,420	123,130	36,710	42.5
Transportation/communication/utilities	28,350	30,200	1,850	6.5
Wholesale trade	9,860	13,710	3,850	39.0
Total	292,700	389,440	96,740	33.0

Source: Association of Bay Area Governments 1989.

would be temporary and would not result in land use changes adjacent to the canal, these impacts would be less than significant. No mitigation is required.

Contra Costa Canal expansion under this alternative could also result in temporary construction nuisances to residential development proposed near pumping plant no. 3. If these residential uses are approved and developed, over 270 dwelling units could experience minor construction nuisances associated with expanding this pumping plant. This potential impact would be less than significant. No mitigation is required.

Expanding canal reach no. 3 could also affect two proposed residential developments that are to be located nearby. Construction-related nuisances could affect over 70 residential units. Because these effects would be temporary and no permanent land use changes would occur in areas adjacent to the canal, this potential impact would be less than significant. No mitigation is required.

Los Vaqueros Reservoir Alternative

The Los Vaqueros Reservoir Alternative is comprised of several project components that are considered separately for identifying project impacts. These project components include the dam and reservoir, the Los Vaqueros pipeline, alternate transfer reservoirs, alternate pipelines, and alternate intake facility sites.

Land Use Impacts of Dam and Reservoir Construction and Operation. Implementation of this alternative would inundate approximately 1,460 acres of land currently devoted to the various land uses discussed above in the "Affected Environment" section.

Livestock Grazing. The Los Vaqueros Reservoir would inundate approximately 828 acres of grazing lands. This impact would be less than significant because this land is only 0.4% of the total grazing land in Contra Costa County. No mitigation is required.

Dryland Farming. The Los Vaqueros Reservoir would inundate approximately 632 acres of dryland farmed lands. This impact would be less than significant because the total value of the crops produced on these lands is substantially less than 1% of the total value of crops produced in Contra Costa County. No mitigation is required.

Williamson Act Lands. The Los Vaqueros Reservoir would not inundate any Williamson Act lands because Williamson Act contracts would be terminated as lands within the Kellogg Creek watershed are acquired by CCWD. Contract termination was considered a less-than-significant impact in the Stage 1 EIR for the Los Vaqueros/Kellogg Project because the watershed would remain in permanent open space, consistent with the primary intent of the Williamson Act.

Windfarming Operations. The Los Vaqueros Reservoir would not directly affect existing windfarming operations. The reservoir would inundate approximately 80 acres, or approximately 2%, of the 3,300 acres that are permitted for future windfarm use in the watershed. This impact would be less than significant because the permitted windfarming lands that would be affected by the reservoir would be a relatively small percentage of the permitted windfarming areas in the watershed and the lowland areas that would be affected are less valuable for windfarming purposes than surrounding uplands. No mitigation is required.

Residential Uses. If the Los Vaqueros Reservoir were constructed, the eight residential units in and near the Los Vaqueros Reservoir and Kellogg Reservoir inundation areas would need to be vacated. Several of these units would be inundated and the remaining units would be vacated to allow for the operation of reservoir facilities and to protect reservoir water quality. Relocating these residents was considered a significant impact in the Stage 1 EIR for the Los Vaqueros/Kellogg Project and could not be

mitigated to a less-than-significant level for residents not wishing to relocate. As CCWD has acquired land, it has compensated property owners for the value of their land and associated improvements, including dwelling units. Impacts relating to the relocation of residences will occur. These impacts would be significant. No mitigation is available. CCWD will also aid in locating alternative dwelling units for displaced persons pursuant to the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

General Plan Consistency. The Kellogg Creek watershed is designated WS for those lands owned by CCWD and AL for privately owned lands under Contra Costa County general plan land use designations. Implementation of this alternative is consistent with these designations. This impact would be less than significant. No mitigation is required.

Land Use Impacts of Recreation in 2025

Agriculture. Development of recreation facilities according to the conceptual Los Vaqueros recreation plan would involve converting approximately 600 acres of the Kellogg Creek watershed to recreation use areas, staging areas, and administration/operations areas. An additional 30-50 acres would be converted for the shuttle road and trail system. Of this total, approximately 640 acres would be converted from grazing uses and 10 acres from dryland farming areas. This land conversion would be a less-than-significant impact because, even combined with the approximately 1,500 acres converted by reservoir inundation, the recreation land use change would represent a less than 1% reduction in countywide grazing and dryland farming operations.

Recreation opportunities provided in the watershed would substantially increase public access to watershed lands, thereby increasing the potential for conflicts between grazing and dryland farming operations and recreationists. The potential conflict with dryland farming would be a less-than-significant impact because recreation in or near dryland farmed areas would be limited to trail use. The conceptual Los Vaqueros recreation plan also identifies development guidelines that would require compatible recreation uses near grazing and dryland farming areas. Chapter 2, "Alternatives Including the Proposed Action", also indicates that recreation use areas and the reservoir would be fenced to keep cattle away from these areas. Therefore, possible conflicts between livestock and recreation users also would be less than significant. No mitigation is required.

Windfarming Operations. Recreation development would avoid windfarming operations. No impact would occur and no mitigation is required.

Rural Residences. Rural residences along Morgan Territory Road that would not be relocated as part of the project would not be affected by recreation development or use because no project facilities are located near these residences and because the recreation development guidelines specify that recreation-oriented public access would be restricted near residences. No impact would occur and no mitigation is required.

Land Use Impacts of Los Vaqueros Pipeline Construction and Operation

Existing Land Uses. Construction of this pipeline would result in the temporary disturbance of crops located within the pipeline right-of-way. This pipeline construction would have little long-term effect on row crop production in the pipeline alignment, but would probably require elimination of orchards in the pipeline right-of-way because tree roots could damage the pipeline. Despite the possibility that orchards would be eliminated from the right-of-way, this impact would be less than significant because these areas could still be retained in agricultural production through conversion to row cropping and other agriculturally related uses. No mitigation is required.

The Los Vaqueros pipeline would pass within 500 feet of one rural residence and two churches near the intersection of Jeffrey Way and Lone Tree Way and one rural residences near Sand Creek Road. Construction of the pipeline alignment would not entail removal of any structures and would create only

relatively minor construction-related nuisances. This impact would be less than significant because construction nuisances would be temporary. No mitigation is required.

The Los Vaqueros pipeline would pass through an area of dispersed gas production operations near San Jose Avenue. The pipeline, however, would be designed to pass below the gas production facilities without interruption in gas pumping operations. No impact would occur.

Proposed Developments. Figure 12-2 shows the location and gives general information on the relevant development proposals near the Los Vaqueros pipeline. The northern portion of the Los Vaqueros pipeline alignment from the Contra Costa Canal to Lone Tree Way would be located in Antioch's Future Urban Area 2, an area designated by the City of Antioch for annexation in 1992 (Dyer pers. comm.).

The Los Vaqueros pipeline would pass near several proposed development projects in Future Urban Area 2. City staff members indicate that the City of Antioch has only recently begun to address the planning issues in the area and no development proposals have formally been accepted. CCWD has negotiated with individual landowners and the City of Antioch to adjust both development site plans and the pipeline alignment to minimize potential conflicts. It is likely that any development proposals would be substantially altered as planning progresses (Carniglia pers. comm.). CCWD should continue to work closely with the landowners in Future Urban Area 2 to properly site the Los Vaqueros pipeline within new development in the area. No significant impacts are anticipated.

The portion of the Los Vaqueros pipeline alignment that lies between Lone Tree Way and the PG&E Hill transfer site is within the Brentwood SOI. CCWD has negotiated with individual landowners planning projects within the Brentwood SOI for the purpose of resolving potential land use conflicts. As a result of this consultation and a memorandum of understanding (MOU) between CCWD and Brentwood establishing guidelines for city action on future land use applications within the pipeline right-of-way, no land use impacts are anticipated.

Construction of the Los Vaqueros pipeline could require modification of a proposal to construct approximately 7,000-8,000 single-family homes southwest of Brentwood. This proposal also includes land devoted to commercial, business park, and public uses. Because the landowner has submitted an application to the county, this potential land use conflict could be a significant impact, depending on the extent of conflict with the developer's plans. Because no approvals for this project have been issued by any agency, however, the magnitude of this impact cannot be determined. To reduce the potential level of impacts of this potential land use conflict, CCWD will coordinate the location of the Los Vaqueros pipeline with proponents of this development to reduce conflicts to the extent it is practicable and cost-effective.

Impacts Common to All Alternate Pipeline and Intake Configurations. If the Los Vaqueros Reservoir Alternative were implemented, one of the seven alternate intake configurations would also be implemented. Each of the alternate configurations consists of an intake facility, transfer reservoir, and pipeline alignment. This discussion identifies land use impacts that are similar for all the alternate configurations. Impacts that are specific to individual configurations are discussed below under the appropriate configuration sections.

Conversion of Agricultural Land. Implementing any of the alternate intake facilities and transfer reservoirs would involve permanent conversion of agricultural or grazing land at the facility sites. The six alternate intake facilities would each require irretrievable commitment of approximately 12 acres of productive or fallow farmland that have been cultivated in past years for asparagus, hay and grain, and other row crops.

Construction and operation of the three transfer reservoir facilities would each involve irretrievable commitment of approximately 10 acres of grazing lands.

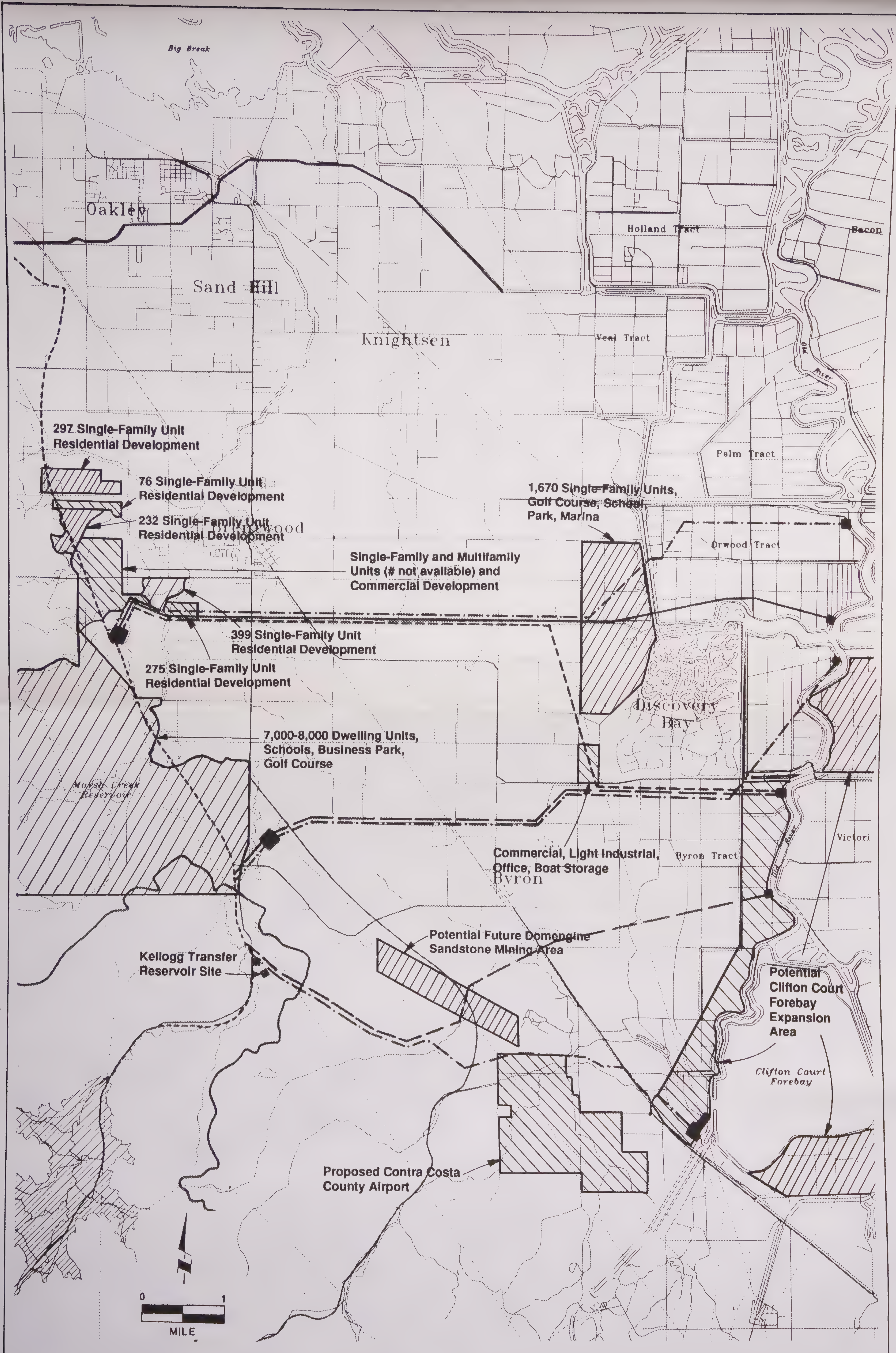


Figure 12-2. Developments Proposed in the Vicinity of the Los Vaqueros Reservoir Alternative (All Configurations)

The irretrievable commitment of approximately 22 acres of agricultural and grazing land would represent a minor loss of east county agricultural resources. The conversion of this small amount of land would not change the conclusion that these impacts would be less than significant, described above under "Land Use Impacts of Dam and Reservoir Construction and Operation".

Construction of any of the seven alternate pipeline configurations could involve permanent or temporary loss of various crops within the pipeline alignment rights-of-way if construction occurs during the growing season. Portions of the alignments that cross land in row crop production could require removal of crops within the right-of-way and temporary loss of the production value of the land while construction occurs. Pipeline construction would require permanent conversion of those lands within pipeline rights-of-way now in production for row crops.

Portions of alignments that cross orchards could result in permanent conversion of orchards to other uses or to other row crops. Orchards would not be allowed in pipeline rights-of-way because the extensive root systems of trees could potentially damage buried pipelines. Temporary or permanent loss of row crops and permanent loss of orchard land would be less-than-significant impacts for several reasons: the majority of row crop production could continue after pipeline construction, loss of orchard land within any of the alternate alignments would represent substantially less than 1% of the total county orchard land in production, and orchard land could be converted to productive row or hay and grain crop production.

Consistency with General Plan Designations. Most of the intake facilities, pipelines, and transfer reservoirs proposed under the alternate configurations would be sited on land designated as either AL, AC, DR or WS. The Clifton Court Forebay intake would be sited on land designated PS.

All the alternate intake facilities, excluding the Clifton Court Forebay intake, would be sited on land designated in the Contra Costa County general plan as DR. The DR designation does not specifically identify intake facilities as an allowable or conditionally allowable use. However, conditional uses in these areas are generally limited to low- to medium-intensity establishments that do not rely on urban levels of service or infrastructure and that do not draw large concentrations of people to flood prone areas (Contra Costa County Community Development Department 1991). Because implementation of the intake facility would be exempt from the local zoning code pursuant to county policy and Section 53096 of the California Community Facilities Act and would not require urban services or draw substantial numbers of people to the site, it is considered consistent with the intent of the DR designation. No impact would result. No mitigation is required.

The Clifton Court Forebay intake would be consistent with the county's PS designation because this land use category allows a wide variety of public and private uses (Contra Costa County Community Development Department 1991). No impact would result. No mitigation is required.

The Kellogg and Camino Diablo transfer reservoirs would be sited on AL-designated land. The AL designation does not specifically address siting of transfer reservoirs on agricultural land, but is generally consistent with the county's intent that this designation "shall not be used to exclude or limit other types of agricultural, open space or non-urban uses" (Contra Costa County Community Development Department 1991). Because implementation of these transfer reservoirs would be a nonurban use that would not impinge on continued agriculture in the area and because a transfer reservoir would be exempt from county zoning regulation, development would be consistent with the AL designation. No impact would result. No mitigation is required.

The PG&E Hill transfer reservoir would be located on AC-designated land. This designation does not specifically identify transfer reservoirs as allowable and is intended to discourage "the placement of utility corridors which would adversely affect the viability of the Agricultural Core" (Contra Costa County Community Development Department 1991). However, based on review of aerial photographs and the county general plan, the transfer reservoir would be located at the western boundary of the AC-designated

area; therefore, it is unlikely that siting the 10-acre facility in this area would cause fragmentation or other conflicts with adjacent agricultural operations. No impact would result. No mitigation is required.

All the alternate pipeline configurations would cross AL-, AC-, or DR-designated land. The western segments of Old River No. 2, No. 3, and No. 4 pipelines would be located either within or immediately adjacent to the ECCID canal corridor, designated PS. Because underground pipelines would generally not affect row crop agriculture; are consistent with county general plan policy allowing pipelines in agricultural areas of the southeastern county (Policy 3-83); and lie predominantly within the AL-, DR-, and PS-designated areas, the pipeline alignments would be consistent with general plan designations and no impacts would result. No mitigation is required.

Land Use Conflicts of the Rock Slough/Old River No. 1 Configuration

Intake Facility. Construction and operation of this intake facility would not result in land use conflicts or create nuisances with adjacent land uses because all the land surrounding the site consists of agricultural land and open space. No impacts would result. No mitigation is required.

The Old River No. 1 intake facility site is located near DWR's proposed enlargement of Clifton Court Forebay (Figure 12-2), an activity that would be undertaken with implementation of DWR's South Delta Water Management Program (California Department of Water Resources 1990b). Substantial uncertainty exists surrounding the timing of DWR's activities and precise proposal. Therefore, determining conclusively whether any land use conflict would result is impossible. For purposes of this analysis, the uses are assumed to be compatible from a land use viewpoint. Therefore, no impacts would result and no mitigation is required.

Kellogg Transfer Reservoir. Construction and operation of this transfer reservoir would not conflict with or create any nuisances for adjacent land uses because the site is surrounded by open space and grazing lands that would be acquired by CCWD. No impacts would result. No mitigation is required.

Pipeline Alignment. Construction of the Old River No. 1 pipeline could require relocating part of a ranching complex located within the alignment west of Byron Highway. This land use conversion would be a significant impact. To reduce this impact to a less-than-significant level, this portion of the pipeline should be relocated northwest of the complex between the ranch facilities and an existing wetland area.

This pipeline would cross a major domengine sandstone resource area (Figure 12-2). Contra Costa County has identified this area as an important resource area in its general plan and has adopted goals and policies that encourage preserving this resource for future mining purposes. This alternate pipeline would cross the sandstone resource area at a point where a concealed fault crosses the area and where the domengine sandstone deposit is bisected by fine-grained arkosic sandstone deposits. The pipeline right-of-way would be located on less valuable sand resources that are not considered domengine sandstone deposits, and it is possible that no direct effect on domengine sandstone deposits would occur. For these reasons, and because the extent and operational procedures for mining of this resource area are uncertain, this impact would not be significant.

Land Use Conflicts of the Rock Slough/Old River No. 2 Configuration

Intake Facility. During the intake construction period, truck traffic to and from the site would travel past a small agricultural processing and storage area on a minor gravel road used to gain access to crop fields. The processing and storage area is located adjacent to the southern side of SR 4 and the western levee on Old River. Construction traffic could potentially disrupt crop loading and trucking operations in this area. This impact would be significant. The impact could be reduced to less-than-

significant levels by constructing an intake site access road immediately to the west of the agricultural processing complex.

As with the Old River No. 1 intake, this intake could potentially conflict with DWR plans to enlarge Clifton Court Forebay (Figure 12-2) as part of its South Delta Water Management Program (California Department of Water Resources 1990b). For the reason stated above under "Land Use Conflicts of the Old River No. 1 Configuration", impacts cannot be determined conclusively. The uses, however, are assumed to be compatible and no impacts would result. No mitigation is necessary.

PG&E Hill Transfer Reservoir. Implementation of this transfer reservoir would not conflict with existing agricultural and open space use of surrounding land because the facility would not fragment land or create nuisances that would diminish use of the adjacent land. No impact would result and no mitigation is required.

Acquisition of the PG&E Hill transfer reservoir site would terminate the Williamson Act contract on approximately 10 acres of grazing land that is scheduled for cancellation in 1996. Because the Williamson Act contract on the remaining portion of the parcel would not be affected and because water storage facilities are generally consistent with the intent of the Williamson Act, this impact would be less than significant as described above under "Land Use Impacts of Dam and Reservoir Construction and Operation".

Pipeline Alignment. Construction of this pipeline alignment would result in several direct and indirect land use impacts related to removing existing residences and structures, temporary construction-related conflicts with existing land uses, and conflicts with proposed developments in advanced planning stages. Implementation of the Old River No. 2 pipeline configuration would result in the following land use conflicts:

- **Disruption of normal activities at an agricultural processing complex located immediately south of SR 4 and west of Old River because of the proximity of pipeline construction traffic.** This impact would be significant. This impact could be reduced to a less-than-significant level by constructing an access road to the Old River No. 2 intake site immediately to the west of the existing light industrial facilities.

- **Possible removal of or disruption to one rural residence located immediately north of the ECCID canal and west of Byron Highway.** The potential for this pipeline alignment to require removal of a rural residential unit would be significant because rural residences in this agricultural area are usually directly related to agricultural production of adjacent farmland. To reduce this impact to a less-than-significant level, the pipeline alignment should be relocated north of the residence.

- **Possible removal or disruption of a rural residence located adjacent to the ECCID canal and west of Walnut Boulevard.** This would be a significant impact for the same reasons discussed above. Because this residence is bound on the south by the canal and on the north by another residence, the pipeline could not feasibly be relocated and this impact would be unavoidable.

- **Construction-related nuisances within 500 feet of 26 rural residences.** One of these residences is located south of SR 4 near the southwest corner of the Discovery Bay residential development. Thirteen of the affected residences are located along Bixler Road between the ECCID canal and SR 4. The remaining twelve residences are located at various points near the ECCID canal alignment. Because these possible construction nuisances are temporary, these impacts would be less than significant. No mitigation is required.

- **Relocation or modification of a gas pumping plant located adjacent to the intersection of the ECCID canal and SR 4.** This impact would be significant. This impact could be avoided by siting the pipeline north of this facility.

- **Possible removal or major modification of a City of Brentwood Department of Public Works maintenance yard located at the intersection of Walnut Boulevard and the ECCID canal.** This impact would be significant. To reduce this impact to less-than-significant levels, the pipeline should be sited north of the maintenance yard.

- **Possible modification of a development proposal (for which a general plan amendment is pending) at the southwest corner of the existing Discovery Bay residential development.** The proposal (Figure 12-2) includes commercial office uses, light industrial uses, and boat storage. This impact would be significant. CCWD could reduce this impact to a less-than-significant level by relocating the pipeline alignment to an area acceptable to the project proponent and to CCWD.

The Old River No. 2 pipeline would be located close to several proposed developments that would be located north of the western terminus of the ECCID canal. Sufficient rights-of-way exist between the canal and these potential developments for pipeline siting. No impacts would occur. No mitigation is required.

Land Use Conflicts of the Rock Slough/Old River No. 3 Configuration

Intake Facility. Construction of the intake at the Old River No. 3 intake site would result in termination of the Williamson Act contract on the 12-acre site. Because the remaining portion of the parcel would be retained under the Williamson Act contract and because the intake site is only a small portion of the parcel, this impact would be less than significant. The significance of this impact when combined with other project components is discussed above under "Land Use Impacts of Dam and Reservoir Construction and Operation".

The Old River No. 3 intake facility is located south of Cruiser Haven Marina at the end of Orwood Road between the Mokelumne Aqueduct and the Santa Fe Railroad tracks. The operation of this marina is not expected to be adversely affected as a result of the operation of the intake facility (Cockrell pers. comm.). Access to this marina could be restricted during the construction phase of the project. Because of the proximity of the marina to the intake facility, and because the only access to the marina and the pumping plant site is over Orwood Road, entry to the marina could be blocked or restricted during the construction phase of the project. Because access to the marina adjacent to the Old River No. 3 intake facility is limited to Orwood Road, the construction phase of this alternative could result in a significant adverse impact on recreation activities by restricting or blocking access to the marina. To mitigate this impact to a less-than-significant level, access to the marina should be maintained during construction.

PG&E Hill Transfer Reservoir. The impacts of constructing and operating the transfer reservoir at the PG&E Hill site would be identical to those described above under "Land Use Conflicts of the Old River No. 2 Configuration".

Pipeline Alignment. Because the portion of Old River No. 3 pipeline that would be constructed along the ECCID canal is identical to that portion of the Old River No. 2 pipeline that would be constructed along the ECCID canal, the impacts would be the same (refer to "Land Use Conflicts of the Old River No. 2 Configuration" above). The impact that would differ from the Old River No. 2 pipeline is modification of a proposal (for which a general plan amendment is pending) to expand the Discovery Bay development to the northwest (Figure 12-2). The proposed development includes 1,670 single-family units, a golf course, school, park, and marina. This potential land use conflict would be significant because the proposal is in advanced planning stages. No mitigation is available that would reduce this impact to a less-than-significant level.

Land Use Conflicts of the Rock Slough/Old River No. 4 Configuration

Intake Facility. The impacts of constructing and operating the intake facility at this site are described above under "Impacts Common to All Alternate Pipeline and Intake Configurations". No additional impacts would result.

PG&E Hill Transfer Reservoir. The impacts of constructing and operating the transfer reservoir at the PG&E Hill site would be identical to those described under "Land Use Conflicts of the Old River No. 2 Configuration".

Pipeline Alignment. Although the eastern portion of the alignment of the Old River No. 4 pipeline differs somewhat from the eastern portion of the Old River No. 3 pipeline, the specific land use impacts identified are identical.

Land Use Conflicts of the Rock Slough/Old River No. 5 Configuration

Intake Facility. This intake facility would be identical to the Old River No. 2 intake; therefore, impacts would also be identical.

Camino Diablo Transfer Reservoir. Use of this transfer reservoir would result in cancellation of the Williamson Act contract on the 10-acre site. Because the remaining portion of the parcel would be retained under Williamson Act contract and the transfer reservoir is only a small portion of the parcel, this impact would be less than significant. The significance of this impact when combined with other project components is discussed above under "Land Use Impacts of Dam and Reservoir Construction and Operation".

Pipeline Alignment. The following land use conversions and conflicts would result from implementation of the Old River No. 5 pipeline:

- **Disruption of normal activities at an agricultural processing plant complex because of the proximity of intake construction traffic.** This impact would be significant. This impact could be reduced to a less-than-significant level by constructing an access road to the Old River No. 5 intake site immediately west of the existing light industrial facilities.

- **Construction-related nuisances would occur within 500 feet of 14 rural residences.** Because these disturbances would be temporary, this impact would be less than significant. No mitigation is required.

Land Use Conflicts of the Rock Slough/Old River No. 6 Configuration

Intake Facility. Construction of the Old River No. 6 intake facility could require modification of a proposed residential development to the east of Discovery Bay (Figure 12-2). This proposed development includes 2,260 single-family units and a marina. No applications have been filed for this project, however, and the impact would be less than significant. No mitigation is required.

Camino Diablo Transfer Reservoir. For a discussion of the impacts of constructing and operating the transfer reservoir at the Camino Diablo site, see the discussion above under "Land Use Conflicts of the Old River No. 5 Configuration".

Pipeline Alignment. All but the easternmost portion of this pipeline alignment would be identical to the Old River No. 5 pipeline. No impacts would occur.

Land Use Conflicts of the Rock Slough/Clifton Court Forebay Configuration

Intake Facility. DWR is expanding the Skinner Delta Fish Protection Facilities to include an additional holding-tank building. This building would also include a seining and collecting area and a tanker loading area. The expansion would be constructed northwest of the existing facilities and would not conflict with the construction or operation of CCWD's Clifton Court Forebay intake facilities (Parreira pers. comm.) No impacts would result. No mitigation is required.

A portion of the intake site is under Williamson Act contract, and no notice of cancellation has been filed. Because the intake would encompass a large portion of the parcel, CCWD may be required to acquire the entire parcel. Acquisition of this parcel would result in cancellation of the Williamson Act contract. This impact on Williamson Act contracted lands would be less than significant. The significance of cumulative project component cancellations of Williamson Act contracts are discussed in the "Impacts of Cumulative Land Conversion" section.

Kellogg Transfer Reservoir. The impacts of constructing and operating this facility would be identical to those described for the Rock Slough/Old River No. 1 configuration. No mitigation is required.

Pipeline Alignment. Implementation of this pipeline configuration would result in the following land use conflict:

- **Possible conflict with the proposed Contra Costa County Airport (Figure 12-2).** The East Contra Costa County Airport Land Use Plan designates the proposed use near the alignment as runway clear zone. Use of heavy construction equipment in this clear zone could render the runway temporarily unsafe for use by air traffic. It is unclear when the proposed airport might become operational. Pipeline construction would likely be completed before the airport. In addition, because coordination between airport officials and CCWD would already be required for pipeline construction on airport property, airport officials would be provided with the information necessary to adjust air traffic to avoid any potential safety hazards This impact would be less than significant. No mitigation is required.

Land Use Impacts of the Vasco Road and Utility Relocation Project

The Vasco Road and Utility Relocation Project EIR fully evaluated the potential land use effects of that project. The discussion below summarizes the pertinent findings of that EIR.

County Line Alignment (Modified). Implementation of this new alignment would result in significant and unavoidable disruption of the landscape character along the road alignment. No mitigation is available to reduce this impact to a less-than-significant level.

This new alignment could also significantly disrupt grazing operations in areas where the road bisects grazing land in a manner that makes continued use of fragmented parcels infeasible or less profitable to operate. To reduce this impact to a less-than-significant level, CCWD has adopted a mitigation measure that requires providing livestock crossing along the alignment.

Although much of the topography near the County Line Alignment (Modified) would be less conducive to growth than the topography near the existing Vasco Road, the County Line Alignment (Modified) could, to some extent, redirect growth along the alignment that might otherwise occur along the existing Vasco Road. To reduce this impact to a less-than-significant level, Contra Costa and Alameda Counties could restrict access to the new roadway and could regulate parcel subdivision along the alignment.

The road relocation project would be inconsistent with policies that encourage maintaining the existing road network in agricultural areas and maintaining Vasco Road as a scenic route. These significant effects were reduced to less-than-significant levels by CCWD's adoption of provisions for livestock crossings along the alignment and the county's designation of the new alignment as a scenic corridor.

Utility Relocations. No significant land use impacts would result from relocating the electric transmission lines, natural gas pipeline, or petroleum pipelines within the proposed corridors. No mitigation is required.

Kellogg Reservoir Alternative

Land Use Impacts of Dam and Reservoir Construction and Operation. Implementation of the project would inundate approximately 1,530 acres of land currently devoted to the various land uses discussed above in the "Affected Environment" section.

Dryland Farming. No dryland farming activities are underway in the Kellogg inundation area; therefore, no impacts would occur to dryland farming activities.

Grazing Uses. The Kellogg Reservoir Alternative would inundate approximately 1,530 acres of grazing lands. This impact would be less than significant because this area contains less than 1% of the total grazing lands in Contra Costa County and because the remaining watershed lands would be preserved for agricultural uses.

Williamson Act Lands. The Kellogg Reservoir would not inundate any Williamson Act contracted lands because the Williamson Act contracts would be terminated as the lands were acquired by CCWD. The impact of contract termination was considered less than significant in the Stage 1 EIR of the Los Vaqueros/Kellogg Project because CCWD would not allow urbanization of the previously contracted lands, consistent with the primary intent of the Williamson Act.

Windfarming Operations. No windfarming operations would be affected by implementation of this alternative. No impacts would result. No mitigation is required.

Residential Uses. If the Kellogg Reservoir were constructed, the eight residential units in and near the Los Vaqueros Reservoir and Kellogg Reservoir inundation areas would need to be vacated. Several of these units would be inundated, and the remaining units would be vacated to allow for the operation of reservoir facilities and to protect reservoir water quality. Relocating these residents was considered a significant impact in the Stage 1 EIR for the Los Vaqueros/Kellogg Project and could not be mitigated to a less-than-significant level for residents not wishing to relocate. As CCWD has acquired land, it has compensated property owners for the value of their land and associated improvements, including dwelling units. Although many parcels containing residences within the Kellogg Creek watershed have already been acquired, several additional parcels may be purchased by CCWD. Therefore, impacts relating to the relocation of residences will occur. These impacts would be significant. No mitigation is available. CCWD may also aid in locating alternative dwelling units for displaced persons.

Land Use Impacts of Los Vaqueros Pipeline Construction and Operation. The land use impacts associated with construction and operation of the Los Vaqueros pipeline under the Kellogg Reservoir Alternative would be identical to the impacts identified for this pipeline under the Los Vaqueros Reservoir Alternative. Construction impacts on agricultural land uses and nearby residential and public facilities would be less than significant. No mitigation is required.

Land Use Conflicts of the Rock Slough/Old River No. 5 Configuration. The impacts of construction and operation of the Old River No. 5 intake, pipeline, and Camino Diablo transfer reservoir are identical to the impacts described under the Los Vaqueros Reservoir Alternative.

Desalination/EBMUD Emergency Supply Alternative

Land Use Impacts of the Desalination Plant Construction and Operation. Constructing the desalination plant would expose two existing rural residences to minor, temporary impacts associated with construction of the desalination facilities. These residences are located to the south and to the east. Because this impact is temporary, it would be less than significant.

Constructing the desalination plant would require removing the rural residence located on the site. This impact cannot be reduced to a less-than-significant level.

The potential noise and aesthetic considerations of operating a desalination plant could represent a land use inconsistency with the future development plans immediately east of the desalination plant site in the area known as the Cypress Corridor (Figure 12-3). This proposed development includes 3,000 to 6,000 single-family and multifamily dwellings (Emerson pers. comm.). Although the project has not made application to the county at this time, the Contra Costa County general plan designates the Cypress Corridor for mixed uses, including both residential, office, and commercial uses.

The desalination plant, however, is separated by approximately 750 feet from this planned development area by an LI-designated parcel. Assuming that the parcel separating the desalination plant and the Cypress Corridor project remains vacant, a 750-foot-wide buffer would be sufficient to avoid any significant impacts. No mitigation is required.

Land Use Impacts of Rock Slough Pipeline Construction and Operation. The Rock Slough pipeline would be located within the street right-of-way along Laurel Road, and the front yards of several residences could be disturbed by construction activities. However, because these impacts would be temporary, and because CCWD would be required to return the affected areas to preproject conditions, this impact would be less than significant.

Along Laurel Road, the Rock Slough pipeline would be immediately adjacent to and possibly affect small portions of three development proposals consisting of 44 units, 229 units, and 38 units (Figure 12-3). All the developments have applications submitted. However, because construction of the pipeline would not affect structures, and because CCWD would be required to return any affected properties to preproject conditions, this impact would be less than significant.

The Rock Slough pipeline would require removing housing units in a development now under construction west of the desalination plant site. This impact would be significant but could be reduced to less-than-significant levels only by relocating the alignment to an alternate location that does not require removal or substantial modification of existing structures or modification of a development proposal in advanced planning stages.

Land Use Impacts of EBMUD Intertie Pipeline Construction and Operation. Constructing and operating the intertie pipeline would take place within 500 feet of one rural residence and two churches located south of the intersection of Jeffrey Way and Lone Tree Way. This impact would be less than significant because construction impacts would be temporary and the pipeline would be buried. No mitigation is required.

Two developments are proposed to be located near the EBMUD intertie pipeline in Future Urban Area 2. CCWD consultants have negotiated with individual landowners and the City of Antioch to adjust both development site plans and the proposed pipeline alignment to avoid potential conflict. City staff indicate that the City of Antioch has only recently begun to address the planning issues in the area and has accepted no development plans as yet. Because of the preliminary nature of the development proposals during preparation of this report (Carniglia pers. comm.), it was impossible to identify impacts.

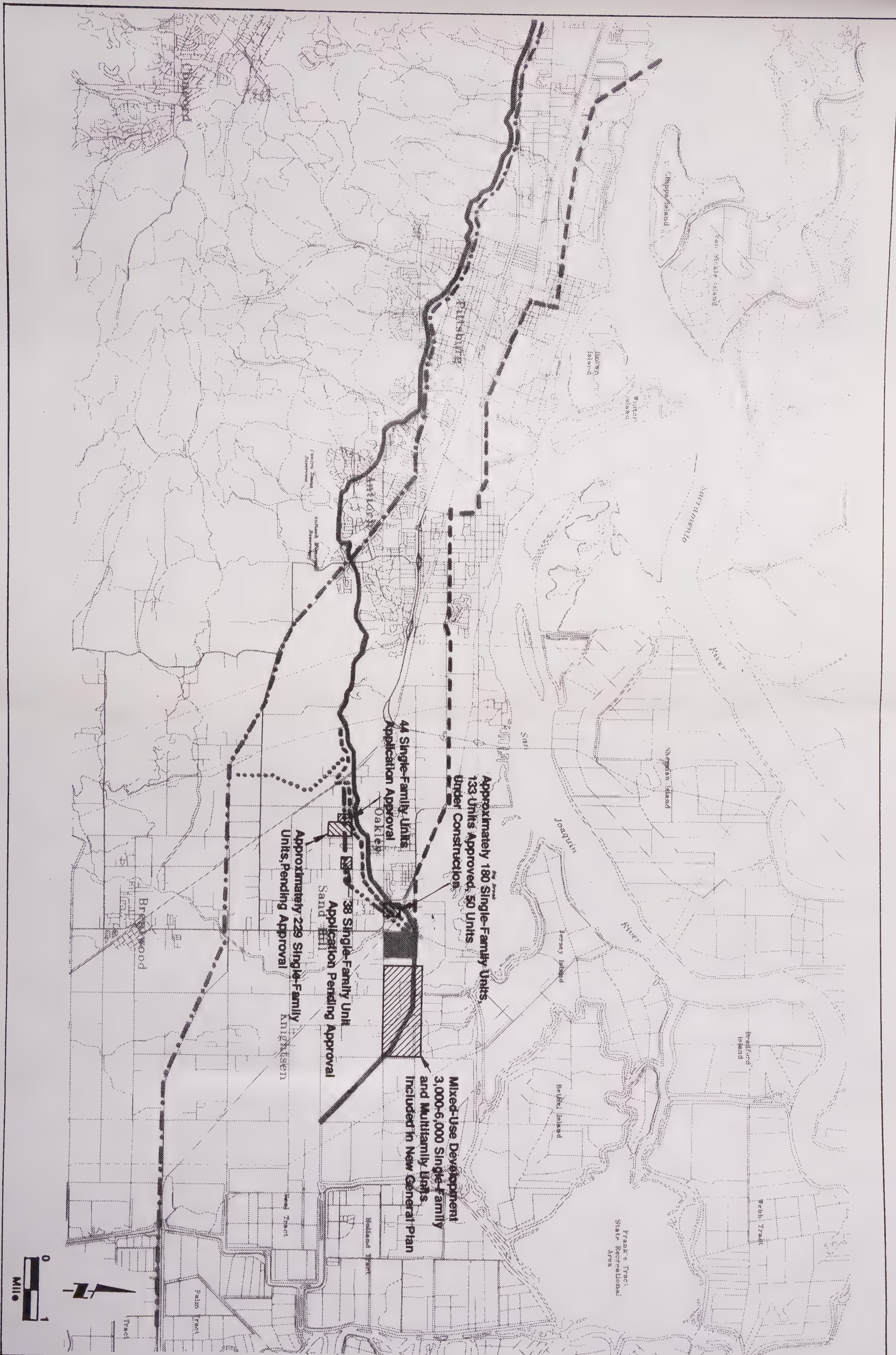


Figure 12-3. Developments Proposed in the Vicinity of the Desalination/
EBMUD Emergency Supply Alternative Facilities

CCWD should, however, develop an MOU with the City of Antioch to require developers to make appropriate land use concessions for the pipeline.

Middle River Intake/EBMUD Emergency Supply Alternative

Land Use Impacts of Facility Construction and Operation

Intake Facility. Woodward Island, the location of the Middle River Intake, is in San Joaquin County. The county land use designation on Woodward Island is AL. Under this designation, only agricultural activities (e.g., raising crops and livestock, agricultural product processing) and lot sizes of 40 acres or larger are allowed. Although this designation would not specifically allow the intake facility, the intake would not be inconsistent with the agricultural uses on the island. This impact would be less than significant. No mitigation is required. The site is not under Williamson Act contract.

Under this alternative approximately 6 acres of land cultivated for row crops would be converted to nonagricultural uses. Because of the small amount of acreage involved, this impact would be less than significant.

Orwood Tract Pumping Plant. Construction activities at the Orwood Tract pumping plant site would be inconsistent with the recreation land uses at the marina to the north of the project site. This impact is described under the Los Vaqueros Reservoir Alternative for Old River No. 3 intake site.

Past land uses near the Orwood Tract pumping plant have been for cultivation of asparagus. Construction and operation of the Orwood Tract pumping plant would convert approximately 6 acres of agricultural land to nonagricultural uses. Because of the relatively small amount of land involved, this impact would be less than significant. No mitigation is required.

Constructing the Orwood Tract pumping plant would result in the removal of the 6-acre site from Williamson Act designation. Because the remaining portion of the parcel would be retained under Williamson Act contract and the impact area is small, this impact would be less than significant.

Because the pumping plant would be exempt from the local zoning code, pursuant to Sections 53091 and 53096 of the California Government Code, and would not require urban services or draw substantial numbers of people to the site, it is considered consistent with the intent of the DR designation. No impacts would result. No mitigation is required.

Middle River Pipeline Alignment. The point at which the Middle River pipeline intersects SR 4 is an area in which continuous development exists adjacent to the roadway. Because of this lack of vacant area in which to site the pipeline alignment, constructing the Middle River pipeline would require removing existing development, resulting in a significant impact. Constructing the Middle River pipeline could require removing or modifying one or more of the following developments: a cement plant, a natural gas pumping plant, and a rural residence. Because no alternative pipeline alignments are feasible that would avoid this development, this impact cannot be reduced to a less-than-significant level.

Constructing the Middle River pipeline could require removing one rural residence at the intersection of the Mokelumne Aqueduct and Eden Plains Road. This would be a significant impact. This impact could be avoided by relocating the portion of the pipeline in conflict with the residence to the south.

The Middle River pipeline would traverse the area designated as the North Brentwood redevelopment area. The plan for development of this area, the North Brentwood Redevelopment Plan, is a program-level document that primarily addresses annexation, redevelopment, and funding for public infrastructure on the 1,036 acres of land north of Brentwood. Constructing the Middle River pipeline would require modification of a 72-unit single-family development proposal in an advanced planning stage (tentative maps have been

submitted and approved) (Figure 12-4). This would be a significant impact. CCWD could reduce the impact to a less-than-significant level by locating the portion of the alignment in conflict with the development to the north by several hundred feet.

If CCWD selects the Middle River Intake/EBMUD Emergency Supply Alternative, it should develop with the City of Brentwood an MOU similar to the agreement developed for regulating land uses near the Los Vaqueros pipeline. This measure would preempt any possible impacts.

Consistency of the Project Alternatives with County General Plan Policies

The county general plan includes nine elements that recommend a wide variety of policies to guide the direction of county land use and growth management, transportation and circulation, public facilities and services, resource and open space conservation, safety, and noise attenuation. The project alternatives would generally be consistent with the majority of these land use policies identified for the East County Area and Oakley-North Brentwood Area. In addition, Policy 3-83 for the southeast county area indicates that pipelines, transmission lines, and public purpose uses (e.g., airports, reservoirs, and landfills) are generally consistent with planned agricultural areas. Policy 3-87 further indicates that CCWD's acquisition of the Kellogg Creek watershed is consistent with the plan (Contra Costa County Community Development Department 1991). The Stage 2 EIR/EIS Technical Report (bound separately) contains a summary of applicable county policies and indicates the consistency of each project alternative with county policies.

For purposes of this analysis, impacts are discussed only if project alternatives appear to be inconsistent with county policy. The No-Action Alternative is considered consistent with county policy. Policy consistency is discussed for the overall project alternatives rather than for individual project components.

Only one minor inconsistency was identified. The Los Vaqueros Reservoir and Kellogg Reservoir Alternatives are generally inconsistent with seismic hazard policy 10-15. This policy is intended to help prevent damage from a seismic event to structures that require a high degree of safety. The Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would place large dam structures in potentially active fault zones. Although the dam design would, as described in Chapter 2, "Alternatives Including the Proposed Action", incorporate state-of-the-art seismic safety precautions, these alternatives would result in the placement of structures requiring a high degree of safety in a potentially active fault zone. This inconsistency with county policy would be a significant impact. See Chapter 4, "Kellogg Creek Water Resources and Public Safety", and Chapter 10, "Geology, Seismicity, and Soils", for a complete discussion of safety-related issues.

The Rock Slough/Old River No. 1 configuration of the Los Vaqueros Reservoir Alternative would be inconsistent with county mineral resource policy 8-56, which states that important mineral resources shall be preserved. This inconsistency with county policy would be a significant impact.

Recreation

Criteria for Conclusions of Significance

Appendix G of the State CEQA Guidelines states that a project normally will have a significant effect on the environment if it will:

- conflict with the adopted environmental plans and goals of the community where it is located, or

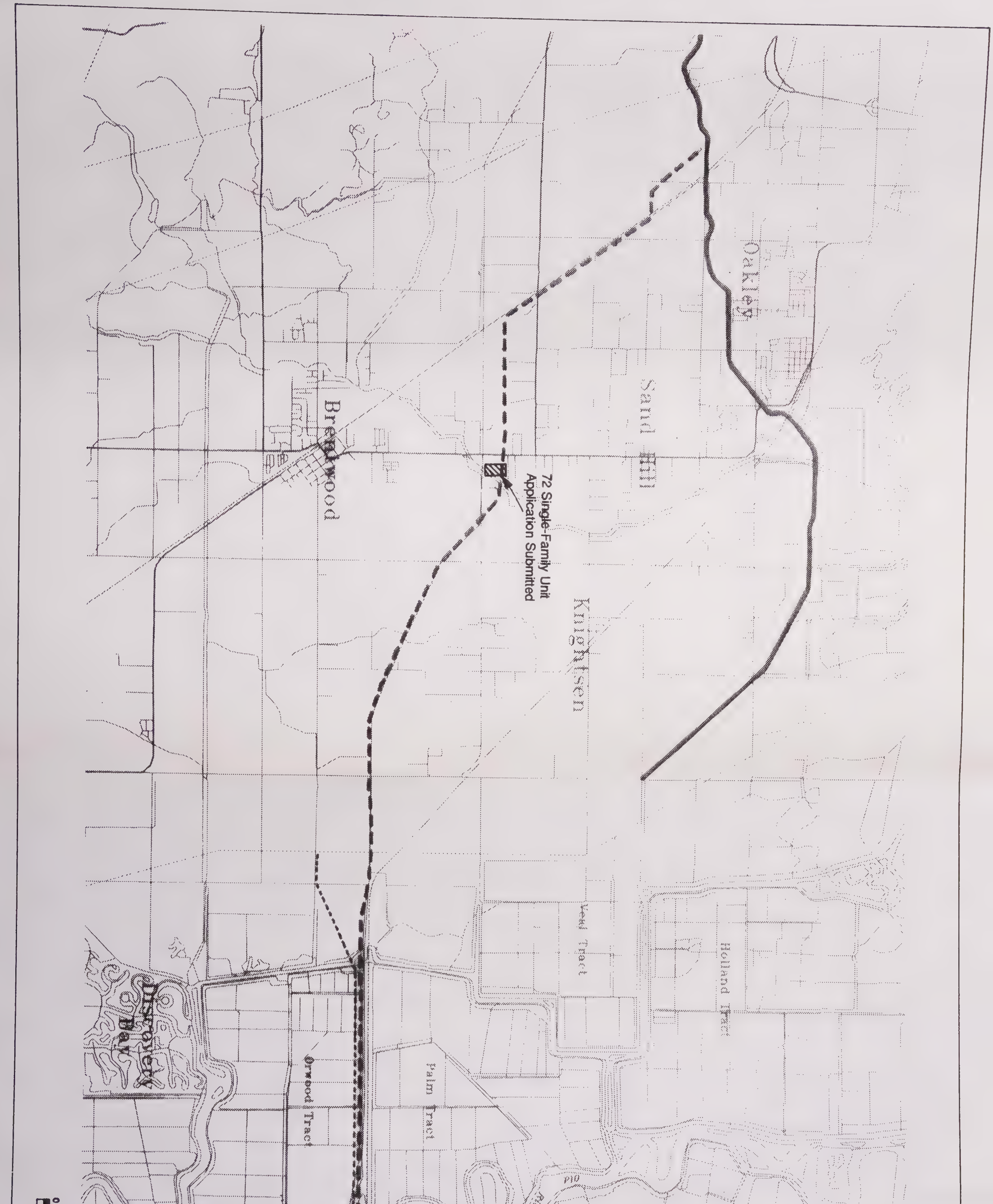


Figure 12-4. Developments Proposed in the Vicinity of the Middle River Intake/ EBMUD Emergency Supply Alternative Facilities

- conflict with established recreational, educational, religious, or scientific uses of the area (California Office of Planning and Research 1986).

The guidelines state that the relative effects of disruption of established uses within an area as a result of construction and operation of a project should be considered when determining the significance of an impact. In turn, the disruption of existing or planned recreation uses in the project area should be considered as part of the overall analysis.

This analysis assumes that an impact on recreation resources in the project area would be significant if recreation resource facilities were physically affected by project facility construction for extended periods of time, if the quality of recreational experiences at any existing recreational facility were permanently degraded, or if project construction or operation were inconsistent with local plans or policies. Unless they are found to be significant, adverse impacts are not discussed.

No-Action Alternative

Under the No-Action Alternative, the assessment assumes that all land in the Kellogg Creek watershed purchased by CCWD would be sold to private individuals or public agencies. Existing land uses in the Kellogg Creek watershed could either continue or be modified under the No-Action Alternative. If all lands in the watershed were sold to private parties, current land uses would be assumed to continue. In turn, the availability of recreation resources and activities also would continue at existing levels. No change to recreation resources would occur.

Improvements assumed to occur under future conditions include widening Rock Slough, expanding existing pumping plants, and enlarging portions of the Contra Costa Canal. All these improvements would be made in existing rights-of-way and would not affect recreation facilities.

Because recreation resources in the project area would not be substantially altered under the No-Action Alternative, no significant adverse impacts would result.

Los Vaqueros Reservoir Alternative

The analysis of the potential impacts associated with the Los Vaqueros Reservoir Alternative assumes that the conceptual recreation plan would be implemented to low or moderate Phase II levels. Phase II consists of diverse recreation, education, and scientific opportunities in the Kellogg Creek watershed. It is characterized by the complete buildout of the facilities and implementation of the resource protection measures proposed in the plan. Peak visitation to the watershed that could be accommodated under the low-level scenario would be 5,300 visitors per day, whereas peak visitation under the moderate-level scenario would be 9,500 visitors per day (Jones & Stokes Associates 1991d). The potential for visitation at the reservoir ranges from 1 million to 3.7 million recreation days per year depending on the fees charged and activities allowed (Jones & Stokes Associates 1991d).

Los Vaqueros Reservoir Draft Recreation Plan. A conceptual draft recreation plan has been developed for the Los Vaqueros Reservoir Alternative (Jones & Stokes Associates 1991d). This plan includes three components that are considered in the analysis of impacts associated with proposed levels of recreation use within the Kellogg Creek watershed. These components are:

- identification of the recreation uses that would be compatible with other watershed resources,
- estimation of recreation use in the watershed if the plan is implemented, and
- development of plan goals and objectives.

The analysis of demand for the facilities proposed in the recreation plan concluded that even with the limitations placed on recreation use as a result of concerns for maintenance of water quality, the Los Vaqueros Reservoir could become one of Contra Costa County's most popular recreation areas (Jones & Stokes Associates 1991d). Although the reservoir would attract visitors to the watershed, much of the recreation demand in the watershed would be focused on land-based activities.

Recreation opportunities in the Kellogg Creek watershed are limited because of controlled public access. Implementation of the conceptual recreation plan would create new recreational opportunities in the watershed by providing public access to these areas. The plan would include a variety of recreation facilities and opportunities. Although the Kellogg Creek watershed would be purchased by CCWD, not all of this land would be open to public access after the reservoir is constructed. Public access to certain areas would be controlled because of resource management considerations. Implementation of the plan would help reach the Contra Costa County goal of 4 acres of parkland per 1,000 county residents (Contra Costa County Community Development Department 1990) and supply additional recreation opportunities to the increasing population levels of Contra Costa County and the region. This additional supply of recreation opportunities in the county and region would be considered a beneficial impact of the project.

Compatibility with Adjacent Recreation Uses. Recreation occurring on lands adjacent to the Kellogg Creek watershed may be affected by the construction and operation of the Los Vaqueros Reservoir. Existing public recreation opportunities on adjacent lands are primarily limited to Morgan Territory Regional Preserve. Recreation in other areas within or adjacent to the Kellogg Creek watershed is limited because of controlled public access.

The major recreation activities at Morgan Territory Regional Preserve are hiking and horseback riding. Total visitation to the preserve, as indicated in Table 12-2, is low compared to most of the other EBRPD facilities. The portion of the Kellogg Creek watershed that abuts the preserve is classified as an area of controlled use in the conceptual recreation plan (Jones & Stokes Associates 1991d).

Under the conceptual recreation plan, the area of the Kellogg Creek watershed adjacent to Morgan Territory Regional Preserve would be managed consistently with the preserve (Jones & Stokes Associates 1990). The new recreation opportunities that would occur as the plan is implemented would result in a beneficial impact on recreational activities at Morgan Territory Regional Preserve because these opportunities would complement those occurring at the preserve and would provide new access to the Kellogg Creek watershed for visitors of the preserve. Because public recreation does not occur adjacent to other parts of the watershed, the implementation of this alternative would have no impact on recreation opportunities on other lands.

The alternate Delta intake facilities on Old River would all be located off the main river channel (James M. Montgomery, Consulting Engineers 1990e). Boating on Old River would not be affected because of the off-channel location of the intake facilities and associated fish screens, and no impacts on recreation opportunities would occur.

Consistency with Plans and Policies

Contra Costa County. The Contra Costa County general plan and the EBRPD and LARPD master plans present policies that address recreation issues in the county and respective regions.

The implementation of the Los Vaqueros Reservoir Alternative and associated conceptual recreation plan would be consistent with the policies stated in the Contra Costa County general plan. This alternative would:

- help reach the target ratio of 4 acres of parkland per 1,000 county residents,

- present a management plan that would be in conformance with the county's goal of complementing natural features and controlling adverse environmental impacts, and

- promote recreation enjoyment of the county's amenities by allowing public access to the Kellogg Creek watershed.

These impacts would be beneficial.

The configuration of the alternative intake and conveyance facilities would avoid significantly altering the recreation opportunities in the Delta and present a potential opportunity to help implement the county's goal of developing a comprehensive and connected hiking, bicycle, and equestrian trail system. Thus, the impacts would be beneficial.

East Bay Regional Park District. Implementation of the Los Vaqueros Reservoir Alternative and selection of any of the pipeline alternatives would not conflict with the plans and policies of EBRPD. Implementation of the conceptual recreation plan would not conflict with the management objectives for Morgan Territory Regional Preserve or for the proposed regional trails (East Bay Regional Park District 1989) and no impacts would result.

Livermore Area Regional Park District. Because none of the conveyance project configurations are under the jurisdiction of LARPD and because the conceptual recreation plan for the Los Vaqueros Reservoir would complement LARPD's development plan for Brushy Peak (Livermore Area Recreation and Park Department 1989) and LARPD goals of natural resource protection and development of recreation facilities, no adverse impacts would result.

Kellogg Reservoir Alternative

Changes in Recreation Use. The Kellogg Reservoir would be located in the Kellogg Creek watershed; current recreation uses within the watershed are described above for the Los Vaqueros Reservoir Alternative. Most of the land in the watershed is closed to public access except for the portion of Morgan Territory Regional Preserve that extends into the Kellogg Creek watershed.

Implementation of a conceptual recreation plan for Kellogg Reservoir would result in increased recreation opportunities in the watershed. However, based on the conceptual recreation plan for Los Vaqueros Reservoir, some of the recreation sites described would not be available under the Kellogg Reservoir Alternative. These sites include the Los Vaqueros equestrian center and the Kellogg Creek recreation and staging area (Jones & Stokes Associates 1991d). These or similar facilities would likely be relocated to different areas of the watershed under the Kellogg Reservoir Alternative. As described under the Los Vaqueros Reservoir Alternative, implementation of this alternative would result in a beneficial impact on recreation opportunities in Contra Costa County and the region by increasing available recreation opportunities.

Compatibility with Adjacent Recreation Uses. Public recreation opportunities on adjacent lands are primarily limited to Morgan Territory Regional Preserve, and are not available in other areas adjacent to the watershed because of controls placed on public access. The portion of the Kellogg Creek watershed that abuts the preserve is classified in the conceptual recreation plan as an area of controlled use (Jones & Stokes Associates 1991d). It is assumed that this area would be similarly classified under the Kellogg Reservoir Alternative.

Because the area of the watershed adjacent to Morgan Territory Regional Preserve would be managed like the preserve, implementation of this alternative would complement activities occurring at the preserve and would provide new access to the Kellogg Creek watershed for visitors to the preserve. This alternative would have a beneficial impact on recreation activities at Morgan Territory Regional Preserve.

Water Conveyance Pipelines. As described under Rock Slough/Old River No. 5 configuration of the Los Vaqueros Reservoir Alternative, no adverse impacts would result from construction or operation of water conveyance pipelines.

Consistency with Plans and Policies. The Contra Costa County general plan and the EBRPD and LARPD master plans include policies that address recreation issues in the county and respective regions. The construction and operation of the Kellogg Reservoir Alternative and the intake conveyance facilities would be in compliance with the Contra Costa County general plan and EBRPD and LARPD master plans, and no adverse impacts would result. These policies are addressed in greater detail above for the Los Vaqueros Reservoir Alternative.

Desalination/EBMUD Emergency Supply Alternative

Compatibility with Existing and Proposed Recreation Uses. None of the facilities that would be constructed under this alternative would affect existing or planned regional parks, reserves, shorelines, or trails. Because this alternative would have no impacts on existing or proposed recreation resources, no adverse impacts would result.

Consistency with Plans and Policies. The Contra Costa County general plan and the EBRPD and LARPD master plans present policies that address general concerns of recreation in the county and respective regions. These plans also specifically address how public works projects can be incorporated to attain Contra Costa County and regional recreational goals.

The implementation of the Desalination/EBMUD Emergency Supply Alternative would be in conformance with both regional and county recreation plans and policies. Although this alternative is not expected to provide a beneficial impact on recreation opportunities in the county or region, it is not expected to conflict with stated recreation policies and goals and no impacts would result. The relevant Contra Costa County and EBRPD plans and policies are outlined above in the "Los Vaqueros Reservoir Alternative" section.

Middle River Intake/EBMUD Emergency Supply Alternative

Evaluation of Effects at the Middle River Intake Facility and Old River Pumping Plant. The location of the intake facility for this alternative would be off the main channel of Middle River; therefore, it is not expected to affect boat traffic and associated recreation use on Middle River, and no adverse impacts would result.

The recreation site nearest the pumping plants that would be constructed under this alternative is the Cruiser Haven Marina located north of the pumping plant between the Mokelumne Aqueduct and the Santa Fe Railroad tracks. The operation of this marina would not be adversely affected during operation of the pumping facility (Cockrell pers. comm.). Because of the proximity of the plant to the marina, however, access to the marina could be affected during the construction phase of the project. A significant adverse impact would result if construction of the pumping plant were to restrict access to the marina. This impact would be reduced to a less-than-significant level if CCWD would not restrict access to the marina during construction activities.

Evaluation of Effects along the Conveyance Pipeline Alignment. The opportunity to use the right-of-way created by the water conveyance pipeline under this alternative may occur if some of the proposed regional trails are aligned to follow the pipeline right-of-way. This opportunity would be a beneficial impact. As indicated in the EBRPD master plan, the exact locations of the proposed regional trails in the eastern part of Contra Costa County have not been determined (East Bay Regional Park District 1989).

Population, Employment, and Housing

Criteria for Conclusions of Significance

According to Appendix G of the State CEQA Guidelines, a significant impact would result if a project:

- has environmental effects that will cause substantial direct or indirect adverse effects on human beings,
- conflicts with adopted plans or goals,
- induces substantial growth or concentration of population,
- displaces a large number of people, or
- disrupts or divides the physical arrangement of an established community.

Similarly, NEPA requires that effects on the human environment shall be evaluated as to their significance. In addition to the above criteria, project-related impacts would be significant if they resulted in a shortage of labor in the local labor market or substantially reduced employment opportunities in the area. Those impacts that met one or more of these criteria are examined below. Less-than-significant impacts are not discussed.

All Alternatives

Using the impact screening criteria described above, no significant impacts to population, housing, or employment would occur with implementation of any of the alternatives under consideration. Both construction and operation of the various alternatives were evaluated for their potential effects. The rationale for these findings of no significant impact is described below.

Construction impacts on population were found to be less than significant because the impact would be temporary, and would likely decrease to preproject levels after construction. The operational impacts on population were found to be less than significant because of the small number of potential long-term jobs (50 or less for each alternative (Hicks pers. comm.) and correspondingly small effect on the local population.

Construction impacts on housing were found to be less than significant because an adequate number of workers live within a 1-hour commute distance of the respective construction sites and because sufficient housing is available in the nearby communities. Operational impacts on housing were found to be less than significant because of the small number of potential long-term jobs available and because adequate housing is available in nearby communities.

Construction impacts on employment were found to be less than significant because the existing labor supply is adequate and no shortage in the local labor market would occur. Operational impacts were found to be less than significant because the increase in employment probably would not be substantial compared to the current labor supply in the area.

In the case of the reservoir alternatives, the loss of agriculture-related employment was found to be less than significant because the amount of employment associated with these types of activities is minimal.

Generally, Contra Costa County residents are unopposed to development or growth, unless that development would result in major impacts on the environment or would reduce the quality of life for all

residents. Contra Costa County voters recently approved a land preservation ordinance, the 65/35 plan, which was designed by the county board of supervisors. The main purpose of the ordinance is to restrict urban development to 35% of the total land in Contra Costa County and to preserve the rest of the land for nonurban uses such as agriculture, open space, wetlands, and parks. The Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would be consistent with this ordinance's intent and would help further its goals by permanently protecting open space lands. The Desalination/EBMUD Emergency Supply and Middle River Intake/EBMUD Emergency Supply Alternatives would be neither consistent nor inconsistent with the ordinance.

Constructing the project alternatives and placing facilities would not have an effect on community values because the effects would be temporary and minor.

MITIGATION MEASURES

Land Use

No-Action Alternative

No mitigation is required.

Los Vaqueros Reservoir Alternative

Land Use Impacts of Dam and Reservoir Construction and Operation

Residential Uses. No mitigation is available to reduce this impact to a less-than-significant level.

Land Use Impacts of Los Vaqueros Pipeline Construction and Operation

12-1: Coordinate siting of the Los Vaqueros pipeline with developers to minimize impacts on proposed future developments. Taking into account cost-effectiveness and engineering feasibility, CCWD should coordinate the location of the Los Vaqueros pipeline with proponents of the proposed development to reduce conflicts to the extent feasible and cost-effective to CCWD.

Land Use Conflicts of the Rock Slough/Old River No. 1 Configuration

12-2: Site the Old River No. 1 pipeline in an area between the ranch complex west of Byron Highway and the existing wetlands to the northwest of the complex. To ensure that the existing structures are not disturbed, CCWD could site the Old River No. 1 pipeline between the ranch complex west of Byron Highway and the nearby wetlands to the southeast.

Land Use Conflicts of the Rock Slough/Old River No. 2 Configuration

12-3: Construct an access road immediately to the west of the agricultural processing plant located near Old River immediately south of SR 4. CCWD could construct an access road immediately west of the agricultural processing plant located on the west side of Old River immediately south of SR 4. This measure would ensure that normal operation of the processing facilities is not disrupted.

12-4: Relocate the portion of the pipeline alignment in conflict with the rural residence located immediately adjacent to the ECCID canal and west of Bryon Highway. CCWD could avoid this impact by relocating the portion of the alignment in conflict with the residence to the north.

No mitigation is available to reduce the impacts on the rural residences located immediately north of the ECCID canal and west of Walnut Boulevard.

12-5: Relocate to the north the portion of the pipeline in conflict with the gas pumping plant at the intersection of the ECCID canal and SR 4. CCWD could avoid modifying or relocating the gas pumping plant at the intersection of the ECCID canal and SR 4 by locating the portion of the pipeline in conflict with this facility to the north.

12-6: Relocate the portion of the pipeline alignment in conflict with the City of Brentwood maintenance yard to the north. CCWD could avoid removal or modification of the City of Brentwood Department of Public Works maintenance yard by locating the portion of the pipeline alignment in conflict with this facility immediately to the north.

12-7: Relocate the portion of the pipeline that is southwest of the existing Discovery Bay development. CCWD could avoid conflicts with a development proposal in this area by relocating the pipeline in consultation with the developers. Relocating the pipeline should take into account economic and engineering feasibility.

Land Use Conflicts of the Rock Slough/Old River No. 3 Configuration

12-8: Avoid Access Conflicts at Cruiser Haven Marina. To mitigate significant impacts resulting from potentially eliminating access to the Cruiser Haven Marina during water conveyance pipeline construction, CCWD should maintain access to the marina via Orwood Road during construction if construction would occur in this area during the peak recreation season (May 1 through September 30). Unavoidable disruptions should be limited to off-season periods. Notice of unavoidable disruptions should be given to operators of the Cruiser Haven Marina at least 1 month in advance.

CCWD could implement measures 12-4 through 12-7 for those impacts that would occur with construction of the pipeline along the ECCID canal.

Proposed Discovery Bay Expansion. No mitigation is available to reduce the impact of the Old River No. 3 pipeline on the westward expansion of Discovery Bay residential development to less-than-significant levels. CCWD should, however, work with the developer to minimize the impact to the extent feasible.

Land Use Conflicts of the Rock Slough/Old River No. 4 Configuration. CCWD could implement measures 12-4 through 12-7 for those impacts that would result from construction of the Old River No. 4 pipeline along the ECCID canal.

Proposed Discovery Bay Expansion. No mitigation is available to reduce the impacts of the Old River No. 4 pipeline on the expansion of Discovery Bay residential development to less-than-significant levels. CCWD should, however, work with the developer to minimize the impact to the extent feasible.

Land Use Conflicts of the Rock Slough/Old River No. 5 Configuration. CCWD could implement measure 12-3 to reduce land use conflicts on the agricultural processing plant at SR 4 and Old River to less-than-significant levels.

Land Use Conflicts of the Rock Slough/Old River No. 6 Configuration. No mitigation is required.

Land Use Conflicts of the Clifton Court Forebay Configuration. No mitigation is required.

Land Use Impacts of the Vasco Road and Utility Relocation Project. No mitigation is available to reduce impacts associated with changes in the rural landscape to less-than-significant levels.

Kellogg Reservoir Alternative

Land Use Impacts of Dam and Reservoir Construction and Operation

Residential Uses. No mitigation is available to reduce this impact to a less-than-significant level.

Land Use Impacts of Los Vaqueros Pipeline Construction and Operation. CCWD could implement mitigation measure 12-1.

Land Use Impacts of the Old River No. 5 Pipeline and Intake Configuration. CCWD could implement mitigation measure 12-3.

Desalination/EBMUD Emergency Supply Alternative

Land Use Impacts of the Desalination Plant Construction and Operation

Impacts on Residential Uses. No mitigation is available to reduce these impacts to less-than-significant levels.

Land Use Impacts of Rock Slough Pipeline Construction and Operation

12-9: Relocate the portion of the Rock Slough pipeline in conflict with the residential development west of the desalination plant site to an area that avoids impacts on existing structure and development proposals. CCWD could relocate the portion of the Rock Slough pipeline in conflict with the residential development under construction west of the desalination plant site to an area that avoids impacts to existing structures and development proposals in advanced planning stages.

Middle River Intake/EBMUD Emergency Supply Alternative

Land Use Impacts of Facility Construction and Operation

12-10: Site the Middle River pipeline in an area that would minimize the removal or modification of the existing development adjacent to SR 4. CCWD could locate the Middle River pipeline so that the minimum possible impact (removal or modification of existing development) occurs. This measure would reduce the impact on existing development, but not to a less-than-significant level.

12-11: Relocate the portion of the Middle River pipeline on Brentwood's northern city limits. CCWD could relocate this portion of the Middle River pipeline to avoid requiring modification of a proposed 72-unit single-family development. This relocation would reduce the impact to a less-than-significant level.

CCWD should implement mitigation measure 12-8 to reduce impacts on Cruiser Haven Marina to less-than-significant levels.

Recreation

All Alternatives

No mitigation is required.

Regional Social Issues

All Alternatives

No mitigation is required.

Chapter 13. Transportation

AFFECTED ENVIRONMENT

Project Area and Regional Roadway Network

The project area is served by a network of transportation facilities, including two interstate freeways, numerous arterials, and local collector streets. Figure 13-1 shows the regional and local roadway network in the project area.

Interstate 580 (I-580) provides regional service south of the project area. Areas served by I-580 include the East Bay, Livermore Valley, and portions of the Sacramento and San Joaquin Valleys. South of the project area, I-580 passes through rolling and mountainous terrain and intersects with arterials at grade-separated interchanges.

SR 4 provides east-west access to several communities located between the northern portions of I-680 and I-5. SR 4 is a primary east county facility that acts as a rural highway in some areas and a low-speed, high-volume roadway in some urban areas.

Local roadways that could be affected by the project alternatives include several arterials that range from medium- to high-speed roadways that connect rural and urban areas in east county to the Livermore Valley. Local roadways that could be affected by project alternatives are described below.

Vasco Road is an important arterial that serves as the primary connector between eastern Costra Costa County, I-580, and the Livermore Valley. Although Vasco Road is an urban roadway at its southern end (with curbs, gutters, and sidewalks), long portions of the roadway north of Livermore traverse rolling, mountainous terrain. Land uses in this area are rural, residential, and agricultural.

If CCWD constructed either the Los Vaqueros Reservoir or the Kellogg Reservoir, a portion of Vasco Road would be inundated. In either case, CCWD would relocate Vasco Road to a new alignment known as the County Line Alignment (Modified). This alignment would divert traffic from Vasco Road near Camino Diablo Road to a point on Vasco Road near the Alameda and Contra Costa County lines. The roadway would be designed to the California Department of Transportation's (Caltrans') rolling and mountainous terrain standards. This roadway relocation project was the subject of the Vasco Road and Utility Relocation Project EIR certified by CCWD in September 1990.

The other roadways that could be affected by constructing the various alternatives are Walnut Boulevard, Marsh Creek Road, and Camino Diablo Road. These roadways are all two-lane arterials with paved, unpaved, or nonexistent shoulders that primarily traverse agricultural lands. Marsh Creek Road has some sharp curves and narrow segments. Some medium-density residential uses are adjacent to Camino Diablo Road within Byron.

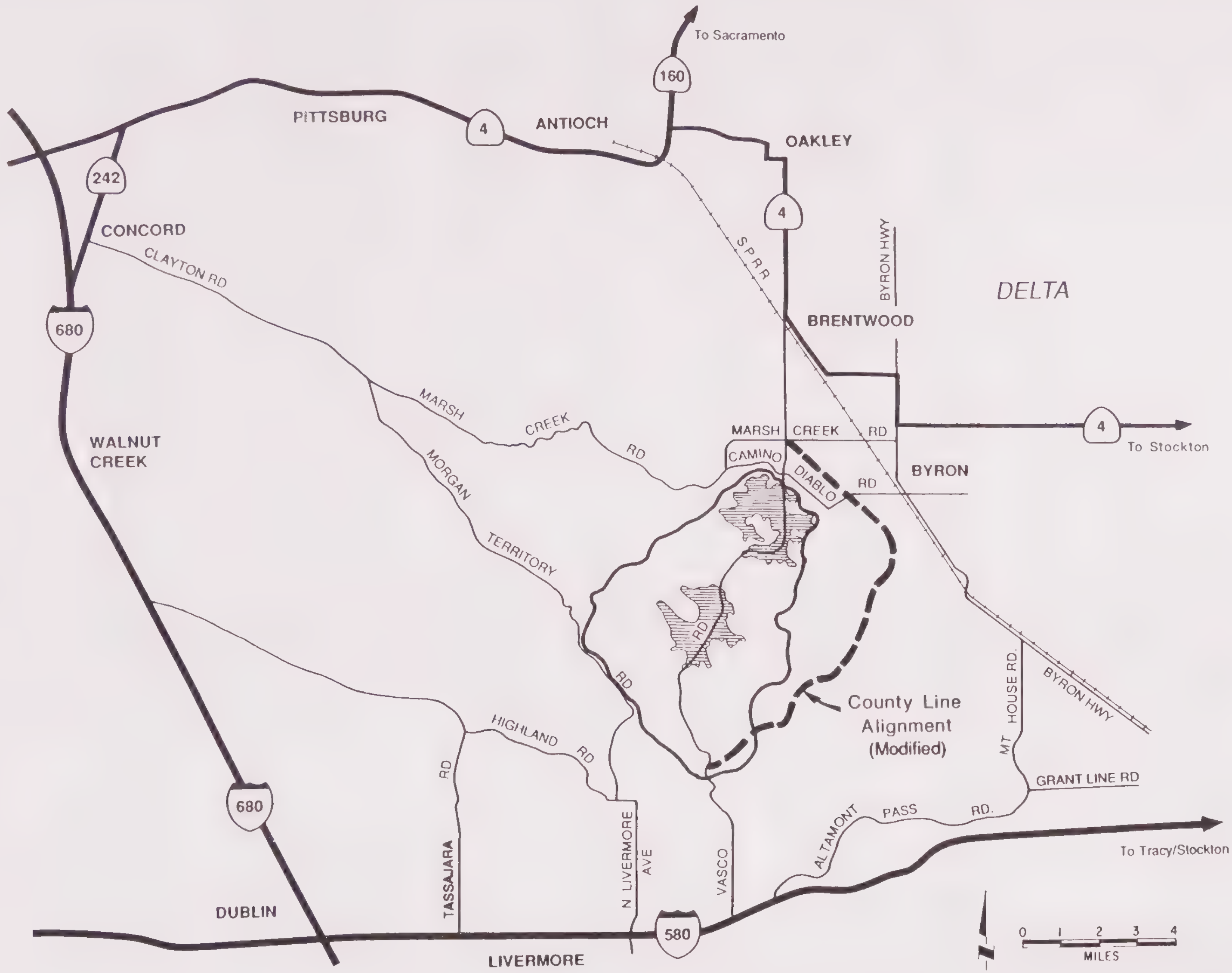


Figure 13-1. Regional and Local Roadway Network

Travel Patterns

Recent Trends

Vasco Road is the primary north-south connector between eastern Alameda and Contra Costa Counties that is used as a commuter route between the counties. A study prepared for the East Contra Costa Transit Authority (Kaplan & Associates 1987) analyzed commuter travel patterns from the Tri-Delta Transit service area to major employment centers in Alameda and Contra Costa Counties. The Tri-Delta Transit service area was defined as the communities of Pittsburg, Antioch, Oakley, Brentwood, Discovery Bay, Jersey Island, and Bethel Island.

The study estimated that in 1986 and 1987 approximately 18,700 commuters traveled from the Tri-Delta Transit service area to major employment centers in Alameda and Contra Costa Counties. Out of this total, approximately 1,300 commuters (approximately 7%) traveled to the Livermore/Pleasanton area.

Future-Year Patterns

Travel patterns for future-year base conditions were assessed using transportation data from the following studies: draft Contra Costa County general plan (Contra Costa County Community Development Department 1989a), Oakley general plan (Goetz pers. comm.), Livermore community general plan circulation element (City of Livermore Planning Department 1989), Livermore I-580/Route 84 traffic study draft report (TJKM Transportation Consultants 1989), and route concept report for I-580 (California Department of Transportation 1985).

Traffic volumes in the study area are expected to increase substantially in the future. The expected increase in traffic volumes is consistent with the increase in land use development projected in the Tri-Delta Transit service area and the Livermore/Pleasanton area. The short- and long-term increases in traffic volumes are discussed below in the "Environmental Consequences" section.

Truck Travel

Several sources, including agricultural uses, commercial deliveries, and truck storage areas, contribute to truck travel in the project area. Two major categories of truck travel exist in the project area: interregional truck travel on I-580, SR 4, I-680, and I-5 and trucks carrying solid waste to the Altamont Pass Sanitary Landfill on Altamont Pass Road and the Vasco Road Landfill.

I-580 serves as a major truck travel route between the San Francisco Bay Area and the San Joaquin and Sacramento Valleys. In the vicinity of the project area, heavy-duty trucks (trucks with three or more axles) represent 13-15% of the annual average daily traffic on I-580 (California Department of Transportation 1988).

TJKM Transportation Consultants conducted a peak-period analysis of heavy-duty truck travel at the intersection of Northfront, Greenville, and Altamont Pass Roads during October and November in 1988. This analysis concluded that approximately 44 heavy-duty trucks pass through the intersection during the a.m. peak hour, and approximately 33 trucks pass through during the p.m. peak hour (Shakerin pers. comm.). This truck travel represents approximately 5% of the total travel through the intersection in the a.m. peak hour and approximately 8% of the total travel in the p.m. peak hour. Observations made by Jones & Stokes Associates indicate that most heavy-duty trucks traveling through the intersection of Northfront, Greenville, and Altamont Pass Roads are going to or coming from the Altamont Pass Sanitary Landfill.

A partial-day truck count was performed by the Alameda County Public Works Department at the intersection of Altamont Pass and Dyer Roads. Results of this count were consistent with the findings of the TJKM Transportation Consultants' heavy-duty truck count.

Information from Browning-Ferris Industries indicates that approximately 250 vehicles per day use the Vasco Road Landfill. This traffic consists of heavy-, medium-, and light-duty vehicles. Over 95% of the vehicles that use the Vasco Road Landfill gain access to the landfill from the south along Vasco Road (Ritchie pers. comm.).

Existing and Future Traffic Operations

Analysis Approach

The existing roadway network, travel patterns, and the County Line Alignment (Modified) (for both reservoir alternatives) were assessed to determine which facilities would most likely be affected by the project alternatives. Critical facilities include intersections, freeway ramps, and roadway segments. The methods and assumptions that were used to assess these facilities are consistent with methods described in the 1985 Highway Capacity Manual (Transportation Research Board 1985), and are described in detail in the Stage 2 EIR/EIS Technical Report (bound separately).

Critical Facilities

Critical facilities that have been selected for detailed traffic analysis of current conditions and future impacts are shown in Figures 13-2 and 13-3 and are discussed below. Facilities that are associated with the County Line Alignment (Modified) are assessed only for future-year conditions and for the two reservoir alternatives because their selection and construction would necessitate relocation of the existing Vasco Road.

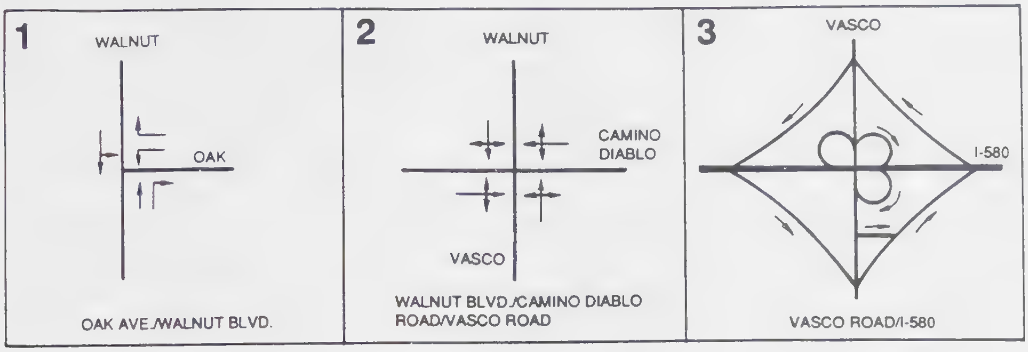
Intersections

- Oak Avenue/Walnut Boulevard,
- County Line Alignment (Modified)/Walnut Boulevard,
- Camino Diablo Road/Vasco Road/Walnut Boulevard,
- Camino Diablo Road/County Line Alignment (Modified), and
- County Line Alignment (Modified)/Vasco Road.

Roadway Segments and Freeway Ramps

- Walnut Boulevard north of Camino Diablo Road,
- County Line Alignment (Modified) north of Camino Diablo Road,
- Camino Diablo Road east of Vasco Road,
- Camino Diablo Road east of County Line Alignment (Modified),
- County Line Alignment (Modified) north of Vasco Road,
- Vasco Road north of the I-580 interchange,
- Vasco Road/I-580 eastbound ramps, and
- Vasco Road/I-580 westbound ramps.

The facilities identified for detailed traffic analysis are those that would be directly affected by construction and operation of the Kellogg Creek watershed reservoir alternatives. Although other facilities would be affected by construction of the alternative pipeline/intake configurations and nonreservoir project alternatives, a screening evaluation of the traffic volumes generated on these intersections and roadway



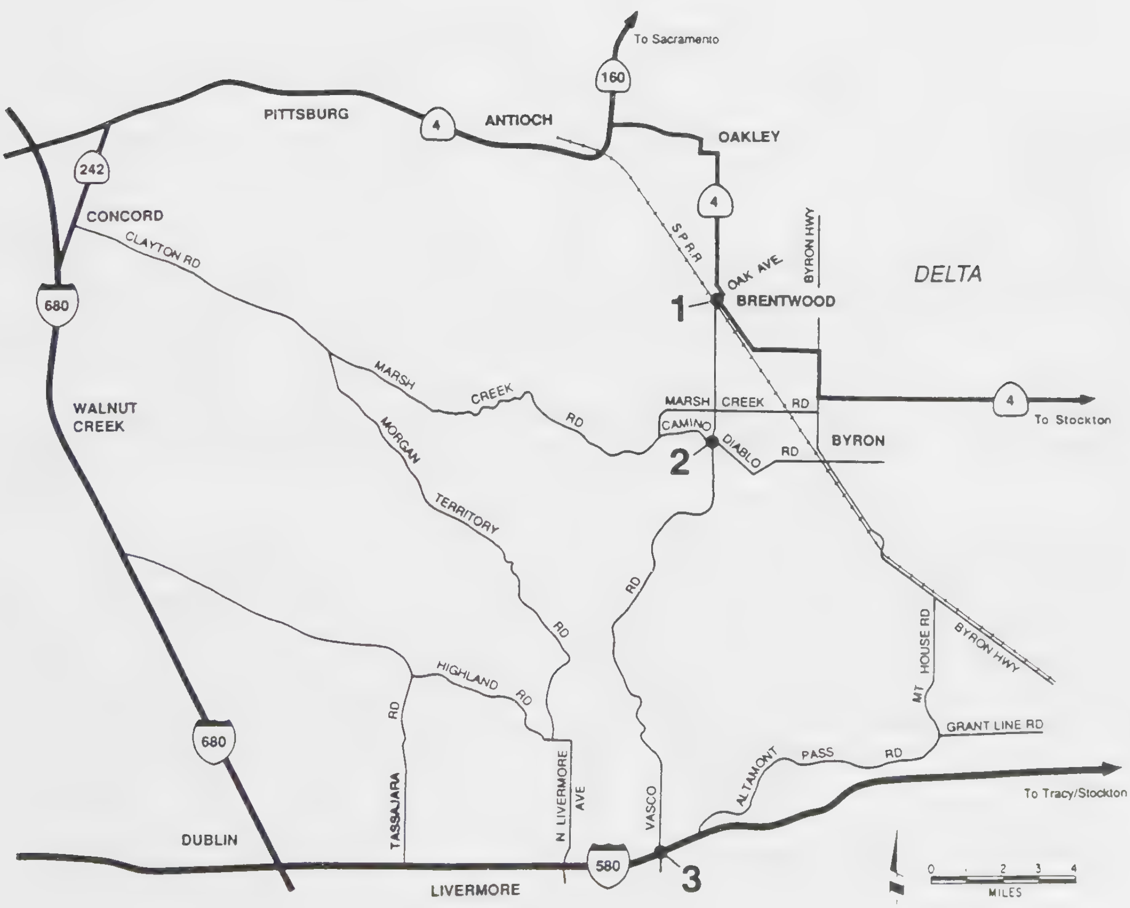


Figure 13-2. Lane Configurations of Existing Critical Intersections

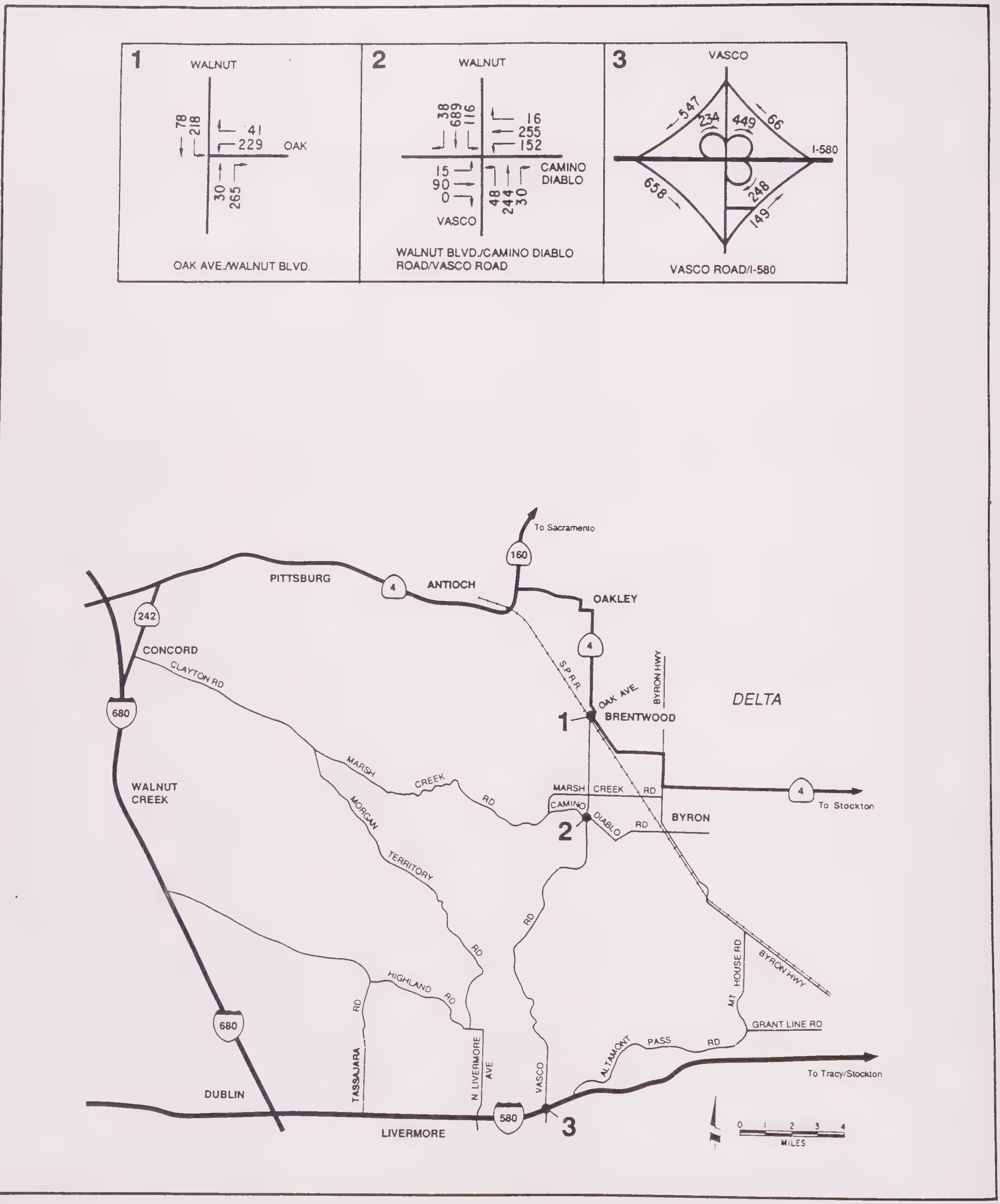


Figure 13-3. Existing (1992) A.M. Peak-Hour Traffic Volumes

segments has indicated that detailed level of service (LOS) analysis is not warranted. Therefore, facilities other than those identified above are evaluated qualitatively.

Intersection and Ramp Controls

Listed below is the type of control at each critical intersection. All intersections are unsignalized and the type of control ranges from no stopping at the Vasco Road/I-580 ramps to a four-way stop at the Camino Diablo Road/Vasco Road/Walnut Boulevard intersection.

Intersection	Type of Control	Approaches That Stop
Vasco Road/I-580 eastbound ramps	Unsignalized	None
Vasco Road/I-580 westbound ramps	Unsignalized	None
Camino Diablo Road/Vasco Road/Walnut Boulevard	Four-way stop, unsignalized	All approaches
Walnut Boulevard/Oak Avenue	Unsignalized "T"	Walnut Boulevard

Intersection Lane Configurations

The existing lane configurations at the critical facilities are shown in Figure 13-2.

Traffic Safety

Table 13-1 presents traffic safety data for the Contra Costa County portion of the Kellogg Creek watershed for 1989 and the first 9 months of 1990. The greatest number of accidents occurred on Vasco Road, but the only fatality occurred on Walnut Boulevard.

Historical accident data for the Alameda County portion of Vasco Road are also shown in Table 13-1 for 1989 and the first 9 months of 1990. One traffic fatality occurred on this segment of Vasco Road during this period.

The I-580 segment, from its junction with I-205 to the Vasco Road interchange, has had an average of 103.5 accidents per year during 1987, 1988, and 1989. Out of the 103.5 average annual accidents, an average of 50.5 accidents per year involved injuries, and an average of 1.7 accidents per year involved fatalities. Taking into account the large number of vehicles that travel I-580, the total accident rate is 0.45 accident per million vehicle miles traveled. This total accident rate is 10% less than the statewide average for the same type of facility in comparable terrain. The portion of SR 4 that is in the project area averaged 2.91 accidents per million vehicle miles traveled in 1987, 1988, and 1989; this average was greater than the statewide average of 1.68 accidents for the same facility type (California Department of Transportation 1990).

Existing (1992) Traffic Volumes

Existing traffic conditions were analyzed using projected 1992 traffic volumes. 1992 traffic volumes were developed as part of the Vasco Road and Utility Relocation Project EIR (Jones & Stokes Associates 1990). Existing a.m. peak-hour traffic volumes at the critical intersections and freeway ramps are presented in Figure 13-3 and p.m. peak-hour volumes for roadway segments are shown in Figure 13-4.

Table 13-1. Number of Accidents on Affected Roadways

Road Segment	Year	Type of Accident: Involving Fatalities	Involving Injuries	Property Damage Only
Vasco Road from Camino Diablo Road to the Alameda County line	1989	0	13	20
	1990	0	11	16
Camino Diablo Road from Marsh Creek Road to the Byron Highway	1989	0	16	6
	1990	0	4	7
Walnut Boulevard from Camino Diablo Road to Brentwood Road	1989	0	6	8
	1990	1	8	7

Source: Vukad and Uy pers. comms.

Number of Accidents on Vasco Road in Alameda County from Contra Costa County Line to Southfront Road

Year	Type of Accident: Involving Fatalities	Involving Injuries	Property Damage Only
1986	1	6	5
1987	0	13	20
1988	0	10	8
1989	0	8	16
1990 (through September)	0	8	6

Source: Preston pers. comm.

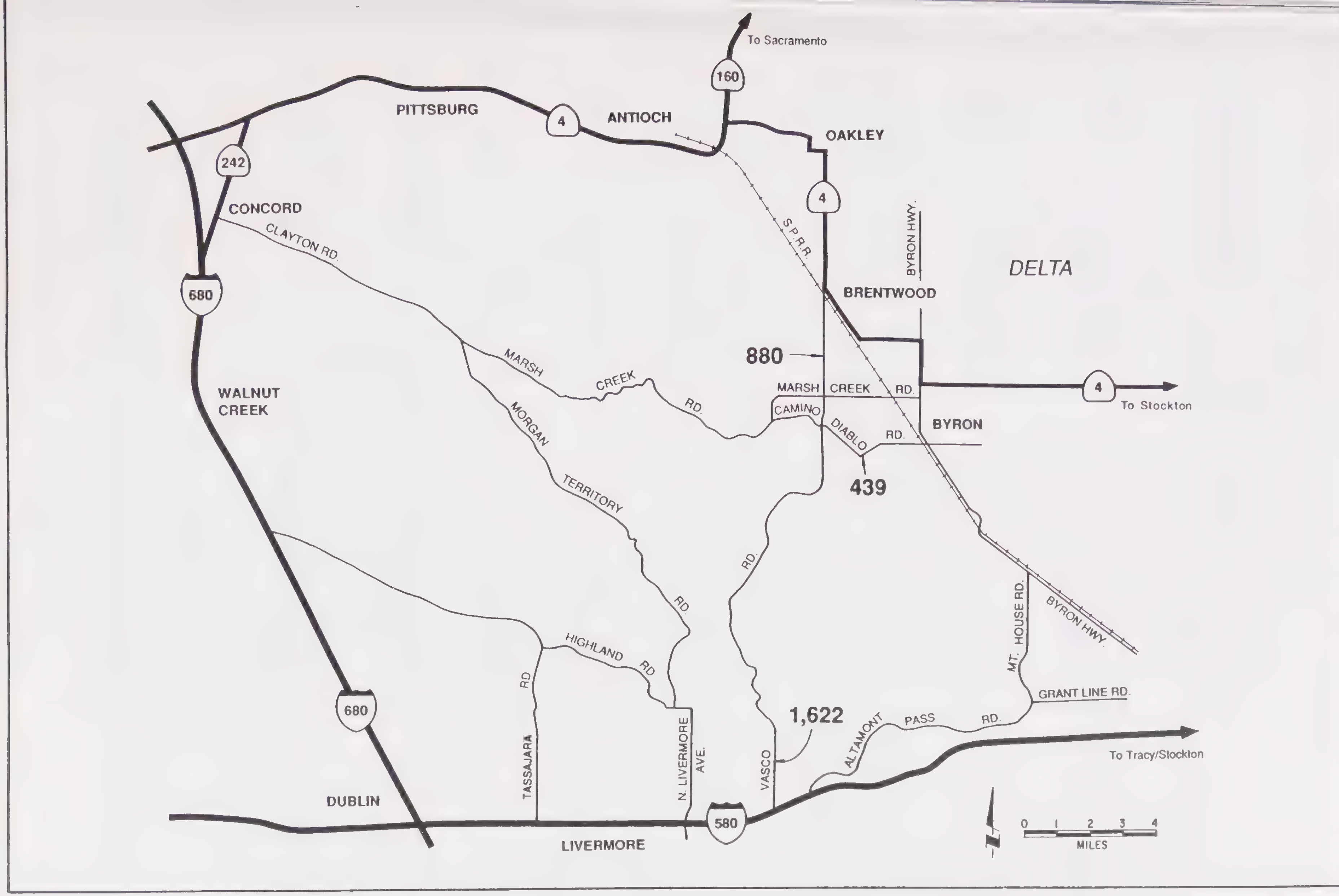


Figure 13-4. Existing (1992) P.M. Peak-Hour Traffic Volumes on Road Segments

Existing (1992) Level of Service

The quality of traffic service provided by a roadway system was measured using the LOS concept. This measure of traffic service quality assigns a letter to describe peak-period driving conditions. The letters A through F are used to describe the best to worst driving conditions, respectively. LOS A indicates free-flow operation, and LOS F denotes jammed flow with substantial delay.

The following is an analysis of existing traffic conditions at critical facilities in the project area. LOS for intersections are determined during peak a.m. periods and LOS for roadway segments are determined for peak p.m. periods. For a complete description of the analysis methods used in this chapter, refer to the Stage 2 EIR/EIS Technical Report (bound separately).

A.M. Peak-Hour Traffic Conditions. Existing a.m. peak-hour volume-to-capacity (V/C) ratios and associated LOS for critical unsignalized facilities and freeway ramps are listed in Table 13-2. Existing traffic operating conditions on the critical intersections are poor, while the ramps function at LOS A. The following is a discussion of the facilities with unacceptable conditions.

Oak Avenue/Walnut Boulevard. Under existing (1992) conditions, this intersection operates at LOS E during the a.m. peak hour with a reserve capacity of 12. The left-turn movement from southbound Walnut Boulevard to eastbound Oak Avenue is the primary contributor to the poor operating conditions. Signal warrants analyses indicate that this intersection meets signal warrants. The combination of LOS E and the need for a signal indicates that this intersection should be signalized to improve operating conditions to an acceptable level.

Camino Diablo Road/Vasco Road/Walnut Boulevard. This intersection operates at LOS F during the a.m. peak hour. The V/C ratio would be 1.06. Heavy projected southbound commuter traffic volumes along Walnut Boulevard and Vasco Road are the primary reasons for the poor operating condition. This LOS is considered unacceptable, but under future Los Vaqueros Reservoir and Kellogg Reservoir Alternative conditions commuter traffic using the County Line Alignment (Modified) would bypass this intersection, thus improving intersection operations.

P.M. Peak-Hour Traffic Conditions. Existing p.m. peak-hour LOS for roadway segments are discussed below. During the p.m. peak hour, portions of Camino Diablo Road and Vasco Road operate at LOS D and E.

Walnut Boulevard North of Camino Diablo Road. Under existing conditions, this roadway segment operates at LOS D because of high commute volumes. This LOS is acceptable for this roadway segment.

Camino Diablo Road East and West of the Vasco Road/Walnut Boulevard Intersection. Under existing conditions, these roadway segments operate at LOS D because of the rolling terrain and high commute volumes. This LOS is acceptable for these roadway segments.

Vasco Road North of the I-580 Interchange. Under existing conditions, this roadway segment operates at LOS E because it traverses rolling to mountainous terrain and accommodates high commute volumes. An acceptable LOS could be attained by widening Vasco Road to four lanes north from the I-580 interchange to the county line.

Public Transit

Other than in the immediate vicinity of Livermore, the project area is generally not served by local transit service because of low ridership potential in rural areas. The project area is identified in the Contra

Table 13-2. Existing (1992) Levels of Service
During Morning Peak Hour

Facility	Volume/Capacity Ratio	Level of Service
Oak Avenue/Walnut Boulevard intersection	NA	E
Camino Diablo Road/Vasco Road/Walnut Boulevard intersection	NA	F
Westbound I-580 ramp to northbound Vasco Road	0.04	A
Southbound Vasco Road to westbound I-580 ramp	0.29	A
Eastbound I-580 ramp to southbound Vasco Road	0.34	A
Northbound Vasco Road to eastbound I-580 ramp	0.08	A
Northbound Vasco Road to westbound I-580 ramp	0.27	A
Westbound I-580 ramp to southbound Vasco Road	0.14	A
Eastbound I-580 ramp to northbound Vasco Road	0.15	A

NA = not applicable.

Costa County general plan, however, as a future transit corridor serving the eastern Contra Costa County and Livermore/Pleasanton areas (Contra Costa County Community Development Department 1991).

In the Livermore area, the Livermore/Amadore Valley Transit Authority provides local service with the Wheels bus lines. This service includes two routes along Vasco Road, providing a connection between the Springtown area and areas in Livermore south of I-580. In addition, Greyhound/Trailways Bus Lines provides interregional transit service between Livermore and Tracy (City of Livermore Planning Department 1989).

Bay Area Rapid Transit (BART) has acquired land near the Greenville Road/I-580 interchange. Although BART is considering constructing a station and maintenance yard in this area, no formal plans have been prepared. Therefore, the impacts of BART's possible construction in this area on the local road system or I-580 is impossible to determine.

ENVIRONMENTAL CONSEQUENCES

Introduction

The impacts addressed in this section are related to construction traffic in 1995 and recreation traffic under the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives in 2025. Construction of alternative facilities is expected to occur between 1993 and 1995; therefore, 1995 is considered the representative year for determining construction-related traffic impacts. Because traffic volumes are greatest during the a.m. peak-hour period, construction traffic impacts on intersections and roadway segments are analyzed for that period.

Recreational use of the Kellogg Creek watershed would not occur until after dam and reservoir construction is completed in 1995. Therefore, recreational traffic impacts would occur after 1995. Recreation traffic impacts are analyzed for 2025 because development of recreation facilities will be phased, and the completion date for all planned recreation facilities is unknown. Because estimating long-range traffic volumes for intersection analysis is highly speculative, LOS conditions in 2025 are analyzed for roadway segments. Existing conditions and 1995 roadway segment LOS are provided for comparison.

Conditions Analyzed

The transportation impacts of the following five primary alternatives and seven Los Vaqueros Reservoir Alternative configurations are analyzed in this section:

Both existing and future reservoir alternative conditions assume that the County Line Alignment (Modified) would replace Vasco Road and that the County Line Alignment (Modified)/Camino Diablo Road intersection would be signalized. A signal at this intersection was adopted as a mitigation measure by CCWD as part of the Vasco Road and utility relocation project.

Impacts of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives were determined by assessing the alternatives' effects on 1995 and 2025 traffic levels; construction-related traffic volumes were added to 1995 traffic levels and buildout recreation-related traffic volumes were added to 2025 traffic volumes. The impacts of other nonreservoir alternatives were assessed by adding construction-related traffic volumes to 1995 traffic volumes. The existing Vasco Road would remain in its present location if a nonreservoir alternative is selected.

Criteria for Conclusions of Significance

Construction-Related Traffic Impacts

Construction of project alternatives could cause temporary transportation impacts, including:

- increased use of roads from transporting construction materials and crews to the work area and
- increased traffic delays caused by construction on or adjacent to a roadway.

Increased Use of Access Roads. Impacts on access roads used to haul construction material and transport workers were considered in three analysis phases. These phases included initial screening for low-level trip generation, LOS analysis, and signal warrant analysis. For a detailed discussion of the methods and assumptions used in these analyses, see the Stage 2 EIR/EIS Technical Report (bound separately).

As recommended by the Institute of Transportation Engineers (1989) for the initial screening of impacts, an increase of 50 or more trucks, 100 passenger vehicles, or an equivalent combination of vehicles per hour in the peak direction during the peak hour required that the potential impact be examined more closely. Increases less than this threshold were considered less than significant.

Intersections or roadway segments that operate at LOS E or F are significant impacts. However, no significant impacts would be attributed to the project alternative if these impacts already occur under the No-Action Alternative.

Increases in traffic volumes or patterns that meet one or more criteria for signal warrants at project area intersections are significant impacts.

In addition, the following impacts are significant:

- traffic delays or detours that would occur for more than 1 week at any location,

- detours greater than 5 miles, or

- traffic flow disruptions with traffic volumes of greater than 15,000 average daily trips (ADT) per lane (rerouting a traffic flow of such volume onto surrounding roadways would likely put the roadway over capacity; a traffic volume of 15,000 ADT per lane also is too high to channel through a reduced number of lanes without substantial delays).

Recreation impacts would be significant if recreation-related traffic, combined with acceptable 2025 LOS conditions (without recreation traffic), would result in an unacceptable LOS (D, E, or F) on roadway segments, or if recreation-related traffic would contribute to 2025 traffic conditions that are projected to be unacceptable without recreation traffic.

No-Action Alternative

CCWD prepared and certified the Vasco Road and Utility Relocation Project EIR in 1990. This EIR analyzed, with an equal level of detail, the transportation impacts of constructing either the County Line Alignment (Modified) or one of five other alternatives to replace the existing Vasco Road. The only significant impact identified was an unacceptable LOS at the intersection of Camino Diablo Road and the County Line Alignment (Modified). As part of certifying the Vasco Road and Utility Relocation Project EIR, CCWD adopted the signalization of this intersection as a mitigation measure. The analyses below, therefore, assume that the County Line Alignment (Modified)/Camino Diablo Road intersection will be signalized.

Reservoir Alternative Baseline - Existing Conditions

Under these conditions (Existing Conditions) projected 1995 traffic volumes are compared to the 1992 traffic volumes described above in the "Affected Environment" section. Because the Vasco Road and Utility Relocation Project EIR was certified and adopted by CCWD, and because the relocation of Vasco Road is scheduled to be completed before 1995, analysis of the reservoir alternatives assumes the County Line Alignment has been implemented (Figure 13-1). This analysis is included to provide a more realistic basis for comparing construction-related traffic impacts with the Los Vaqueros Reservoir and Kellogg Reservoir alternatives. Figure 13-5 lists the critical intersection configurations associated with the County Line Alignment.

1995 Traffic Volumes. Traffic volumes projected for 1995 were based on a series of population growth projections for the planning area. Sources for these projections include Association of Bay Area Governments (1989) population projections and projections provided by James M. Montgomery, Consulting Engineers (Blackmer pers. comm.). Projections that were not available were estimated from existing data. Growth factors based on these growth projections were then applied to obtain 1995 traffic volumes. Figure 13-6 lists the projected a.m. peak-hour traffic volumes.

Impacts on A.M. Peak-Hour Traffic Conditions. LOS for critical facilities under this alternative are listed in Table 13-3. Projected operating conditions at the critical intersections are poor, with the exception of the Camino Diablo Road/Vasco Road/Walnut Boulevard intersection, which is improved by rerouting traffic onto the County Line Alignment, and the County Line Alignment (Modified)/Camino Diablo Road intersection. All I-580 ramps would operate at acceptable levels.

Analysis conducted to assess the No-Action Alternative impacts on a.m. peak-hour traffic conditions yielded a number of less-than-significant impacts, one beneficial impact, and one significant adverse impact. Those project area intersections that would be unaffected or only slightly affected are:

- County Line Alignment/Walnut Boulevard,
- Camino Diablo Road/County Line Alignment,
- County Line Alignment/Vasco Road, and
- Vasco Road/I-580 eastbound and westbound ramp.

Additionally, the Camino Diablo/Vasco Road/Walnut Boulevard intersection would improve over 1992 conditions because traffic would be rerouted to the County Line Alignment (Modified) away from Walnut Boulevard and Vasco Road.

Under this baseline condition, the Oak Avenue/Walnut Boulevard intersection would operate at an LOS F and would meet preliminary signal warrants. This decreased efficiency would be caused by the high-volume left-turn movement going from southbound Walnut Boulevard to eastbound Oak Avenue. This impact is significant and would be reduced to less-than-significant levels by signalizing the intersection.

Impacts on P.M. Peak-Hour Traffic Conditions. The projected 1995 p.m. peak-hour LOS for roadway segments under this alternative are presented in Table 13-4 and Figure 13-7. During the p.m. peak hour, Camino Diablo Road and the County Line Alignment (Modified) north of Camino Diablo Road would operate at an acceptable LOS. In addition, the portion of Walnut Boulevard between the County Line Alignment (Modified) and Camino Diablo Road would operate at an improved LOS of B. This would be considered a beneficial impact. The significant impacts on p.m. peak-hour traffic conditions are discussed below.

The portion of the County Line Alignment (Modified) between Vasco Road and Camino Diablo Road would operate at LOS F. This impact is the result of relocating unacceptable traffic conditions from existing Vasco Road to the County Line Alignment (Modified); therefore, this impact represents continuation of an

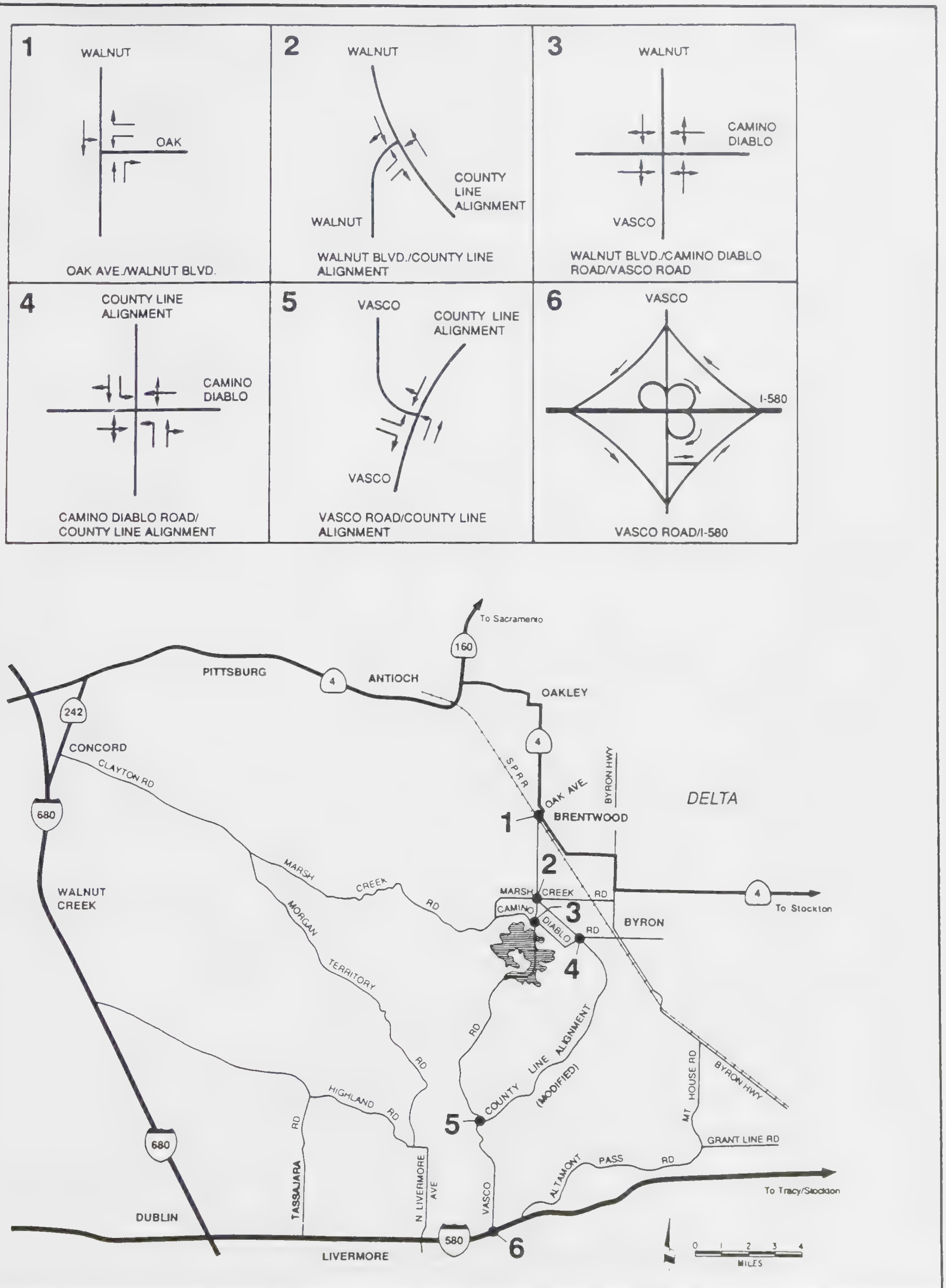


Figure 13-5. Lane Configurations of 1995 Critical Intersections

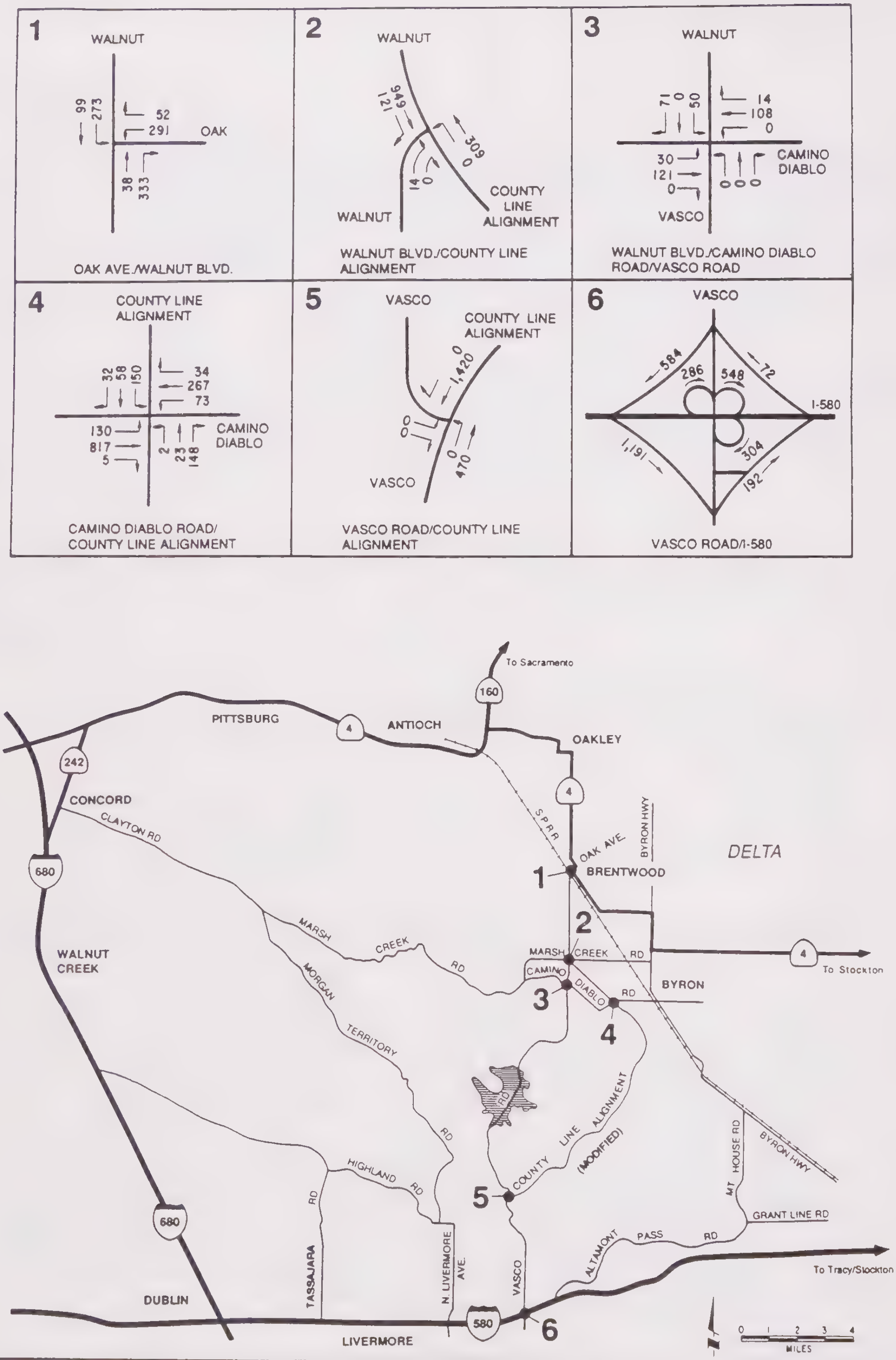


Figure 13-6. Reservoir Alternative Baseline - Existing Conditions (1995) A.M. Peak-Hour Traffic Volumes

Table 13-3. Levels of Service for Intersections and Freeway-Related Facilities during A.M. Peak Hour (1995)

Intersection Freeway Facility	No-Action Alternative Existing Conditions (1995)		Los Vaqueros Reservoir Alternative		Kellogg Reservoir Alternative	
	V/C Ratio	LOS	V/C Ratio	LOS	V/C Ratio	LOS
Walnut Boulevard/Oak Avenue		F		F		F
Walnut Boulevard/County Line Alignment		E		E		E
Walnut Boulevard/Camino Diablo Road		A		A		A
Camino Diablo Road/County Line Alignment	0.77	C	0.77	C	0.77	C
Vasco Road/County Line Alignment		NA		E		D
Westbound I-580 to northbound Vasco Road	0.04	A	0.05	A	0.05	A
Southbound Vasco Road to westbound I-580	0.31	A	0.32	A	0.31	A
Eastbound I-580 to southbound Vasco Road	0.63	B	0.63	B	0.63	B
Northbound Vasco Road to eastbound I-580	0.10	A	0.10	A	0.10	A
Northbound Vasco Road to westbound I-580	0.33	A	0.33	A	0.33	A
Westbound I-580 to southbound Vasco Road	0.17	A	0.17	A	0.17	A
Eastbound I-580 to northbound Vasco Road	0.18	A	0.21	A	0.21	A

Note: NA = not applicable.

Table 13-4. Road Segment Levels of Service during P.M. Peak Hour (2025)

Location	No-Action Alternative: Existing Conditions (1995)	No-Action Alternative: Future Conditions (2025)	Los Vaqueros Reservoir Alternative	Kellogg Reservoir Alternative
Walnut Boulevard	B	B	B	B
Camino Diablo Road east of County Line Alignment	C	E	E	E
Camino Diablo Road west of County Line Alignment	B	C	D	D
County Line Alignment between Marsh Creek Road and Camino Diablo Road	D	F	F	F
County Line Alignment between Camino Diablo Road and Vasco Road	F	F	F	F
Vasco Road between County Line Alignment and I-580 junction	E	F	F	F

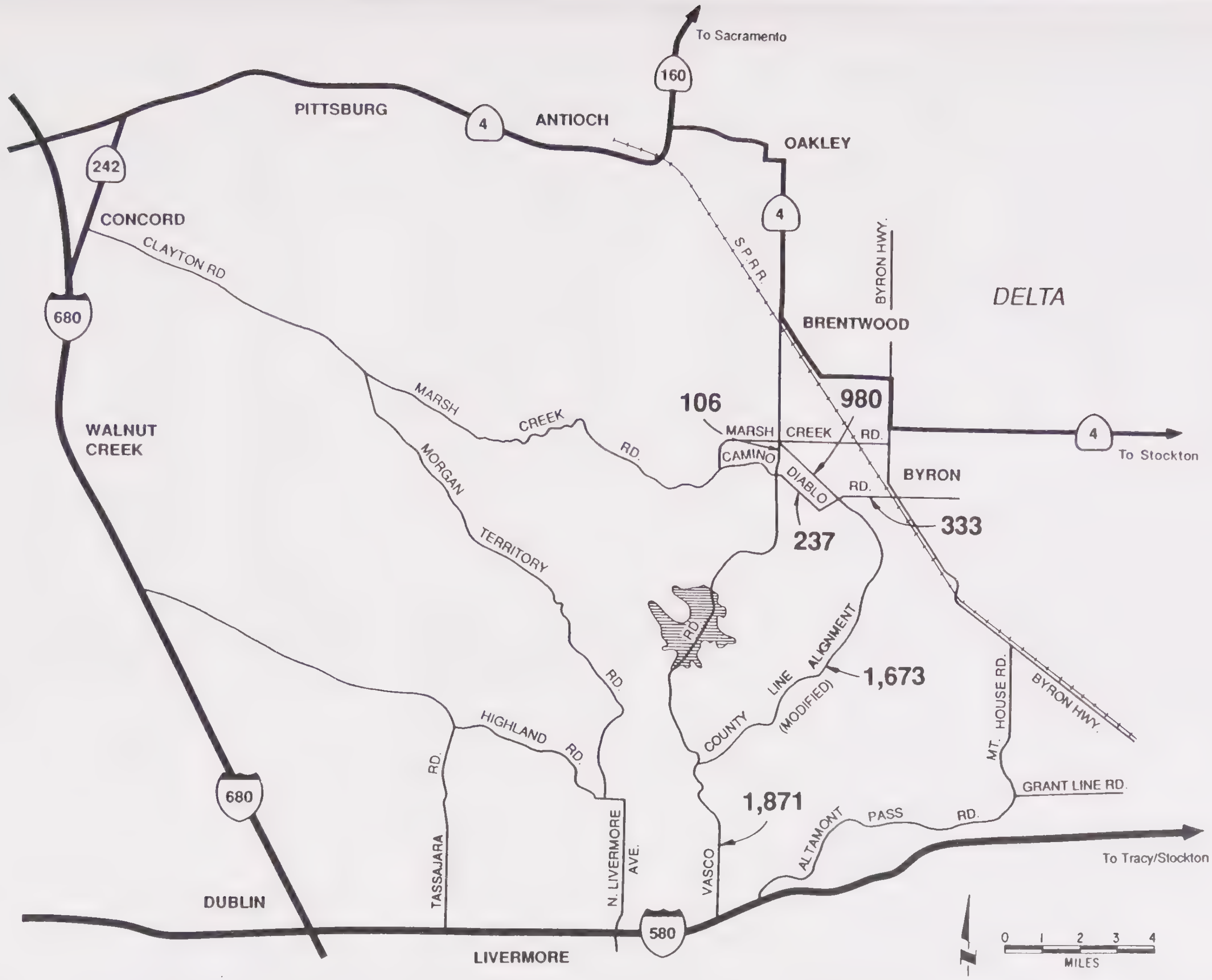


Figure 13-7. Reservoir Alternative Baseline - Existing Conditions (1995) P.M.
Peak-Hour Traffic Volumes on Road Segments

unacceptable transportation problem that exists under 1992 conditions without the County Line Alignment (Modified). No additional impacts caused by the County Line Alignment (Modified) would occur under this alternative; however, this transportation problem would be a significant impact. To reduce this impact to a less-than-significant level, the County Line Alignment should be widened to four lanes between Vasco Road and Camino Diablo Road.

Vasco Road between I-580 and the County Line Alignment (Modified) would operate at LOS E because of heavy commute traffic. This impact is an unacceptable transportation problem that exists under 1992 conditions without the County Line Alignment. No additional impacts caused by the County Line Alignment would occur under this alternative. This transportation problem would be a significant impact. To reduce this impact to a less-than-significant level, Vasco Road should be widened to four lanes between the I-580 interchange and the southern end of the County Line Alignment (Modified).

Traffic Safety Impacts. These conditions would result in some critical facilities operating under congested conditions. These poor traffic conditions could increase accident rates at intersections and along roadway segments associated with the increased density of vehicles on the road and hazardous turning movements. The National Cooperative Highway Research Program Report 282 - Multilane Design Alternatives for Improving Suburban Highways (NCHRP282) (Transportation Research Board 1986) notes that:

> Both engineering judgement and design examples developed from a safety data base suggest that highly congested sites have higher accident rates than the average. . . . Although this conclusion cannot be quantified or proven statistically from the safety data base, it appears reasonable and it can form the basis for judgement about increased safety effectiveness estimates for some projects on congested highways.

Although road improvements associated with the County Line Alignment would improve travel conditions between Contra Costa and Alameda Counties, projected 1995 traffic volumes indicate that traffic congestion will continue to be a problem. Greater traffic congestion in 1995 would increase the potential for traffic accidents above the level occurring under the existing 1992 conditions. This potential accident rate increase would be a significant impact. No additional mitigation measures are recommended to reduce accident rates because the impact is not related to any specific road site or feature. The potential for increased accident rates is more directly attributable to overall project area traffic congestion associated with traffic volume growth. To reduce this impact to a less-than-significant level, the mitigation measures described for critical intersections and roadway segments should be implemented.

Reservoir Alternative Baseline - Future Conditions

Under these conditions (Future Conditions), projected 2025 traffic volumes are compared to the 1992 traffic volumes described above in the "Affected Environment" section. This analysis is included primarily to provide a basis for comparing the recreational traffic impacts of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives.

2025 Traffic Volumes. As with analysis of 1995 traffic volumes, the 2025 traffic volume projections were based on a series of population-growth projections for the planning area. Growth factors, based on these growth projections, were applied to obtain 2025 traffic volumes. Figure 13-8 shows the 2025 p.m. peak-hour traffic volumes for this alternative.

Impacts on P.M. Peak-Hour Traffic Conditions. Projected 2025 p.m. peak-hour LOS for roadway segments are listed in Table 13-4. During the p.m. peak hour, only Camino Diablo Road west of the County Line Alignment and Walnut Boulevard between County Line Alignment and Camino Diablo Road would operate at acceptable LOS. The remaining segments would function at unacceptable levels.

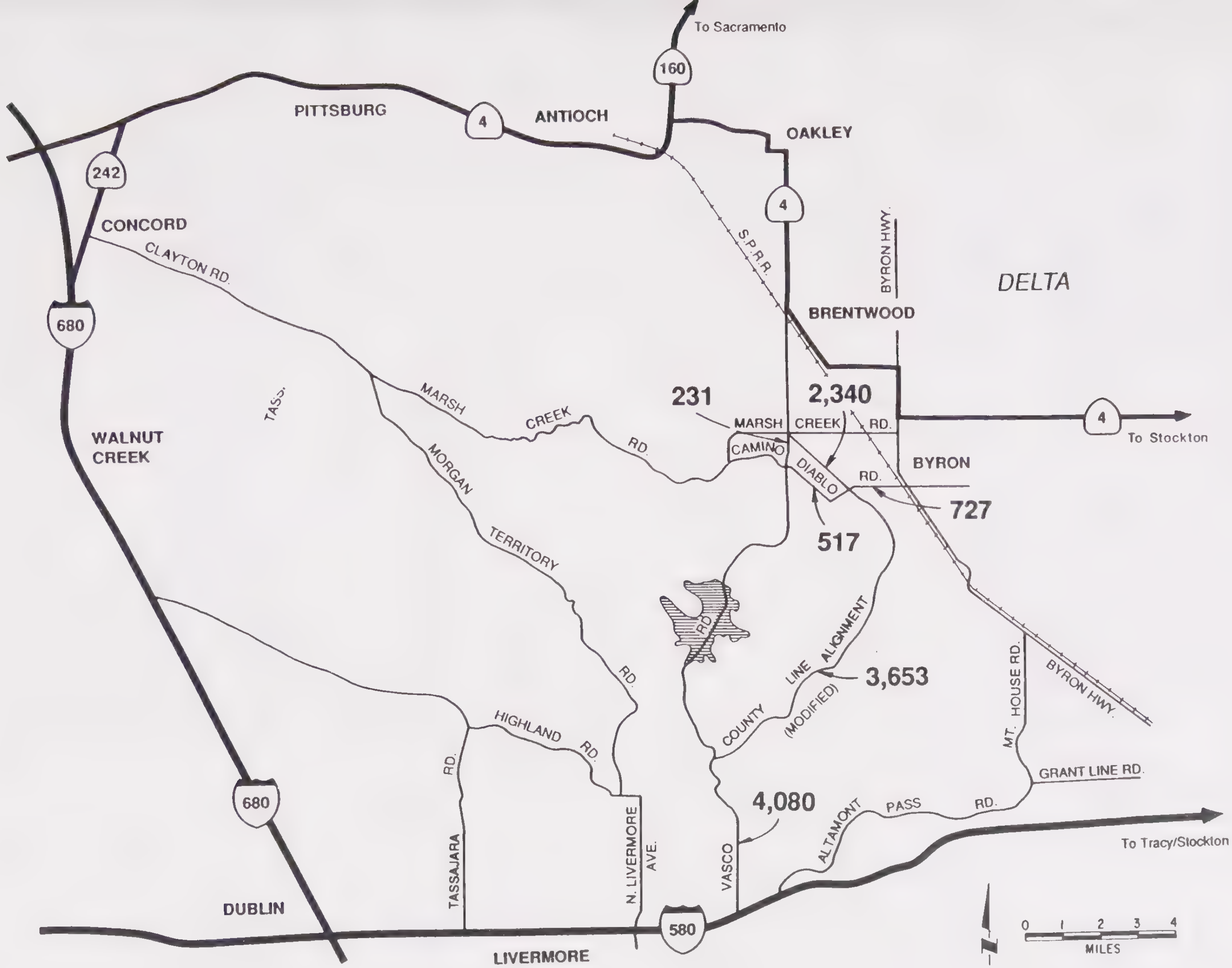


Figure 13-8. Reservoir Alternative Baseline - Future Conditions (2025) P.M. Peak-Hour Traffic Volumes on Road Segments

Camino Diablo Road Segment East of the County Line Alignment (Modified). This facility would operate at LOS E during the p.m. peak hour, which is an unacceptable LOS. Therefore, this impact would be significant. To reduce this impact to a less-than-significant level, Camino Diablo Road should be widened to four lanes east of the County Line Alignment (Modified) to Byron Highway when traffic volumes warrant this improvement.

County Line Alignment North of Camino Diablo Road. Because of heavy commute traffic and limited passing opportunities, this facility would operate at LOS F during the p.m. peak hour, which is an unacceptable LOS. Therefore, this impact would be significant. To reduce this impact to a less-than-significant level, the County Line Alignment (Modified) should be widened to four lanes between Walnut Boulevard and Camino Diablo Road when traffic volumes warrant this improvement.

County Line Alignment North of Vasco Road. The portion of the County Line Alignment located between Vasco Road to the south and Camino Diablo Road to the north would operate at LOS F. This impact would be significant. To reduce this impact to a less-than-significant level, the County Line Alignment (Modified) should be widened to four lanes between Vasco Road and Camino Diablo Road.

Vasco Road North of the I-580 Interchange. Under this alternative, this facility would operate at LOS F. This impact would be significant. To reduce this impact to a less-than-significant level, Vasco Road should be widened to four lanes between the I-580 interchange and County Line Alignment (Modified).

Traffic Safety. The traffic safety impacts of this alternative would be similar to the impact identified for Existing Conditions. Projected 2025 traffic volumes would be greater than under 1995 conditions, thereby increasing the potential for traffic accidents on congested facilities. This impact would be significant. To reduce this impact to a less-than-significant level, the measures recommended for critical intersections and roadway segments should be implemented.

Los Vaqueros Reservoir Alternative

Assessing the total impacts of construction related trips required that certain assumptions be made. Assumptions were made concerning:

- the temporal and geographic distributions of construction trips,
- passenger car equivalency of construction vehicles, and
- peak-hour distribution of construction trips.

These assumptions are discussed in detail in the Stage 2 EIR/EIS Technical Report (bound separately).

Impacts of Construction Traffic on A.M. Peak-Hour Traffic Conditions. Constructing the Los Vaqueros Reservoir would result in essentially the same impacts as those that would occur in 1995 without the alternative (Table 13-3). Projected base traffic volumes in the project area place many facilities at unacceptable LOS, which results in a need for improvement. Figure 13-9 lists the projected traffic volumes for the critical intersections. The addition of estimated construction traffic would not affect the LOS on roadways in the project area. Project implementation would cause no impacts or less-than-significant impacts on the following intersections:

- Oak Avenue/Walnut Boulevard,
- County Line Alignment (Modified)/Walnut Boulevard,
- Camino Diablo Road/Vasco Road/Walnut Boulevard,
- Camino Diablo Road/County Line Alignment (Modified), and
- Vasco Road/I-580 eastbound and westbound ramp.

The significant impacts of dam and reservoir construction are discussed below.

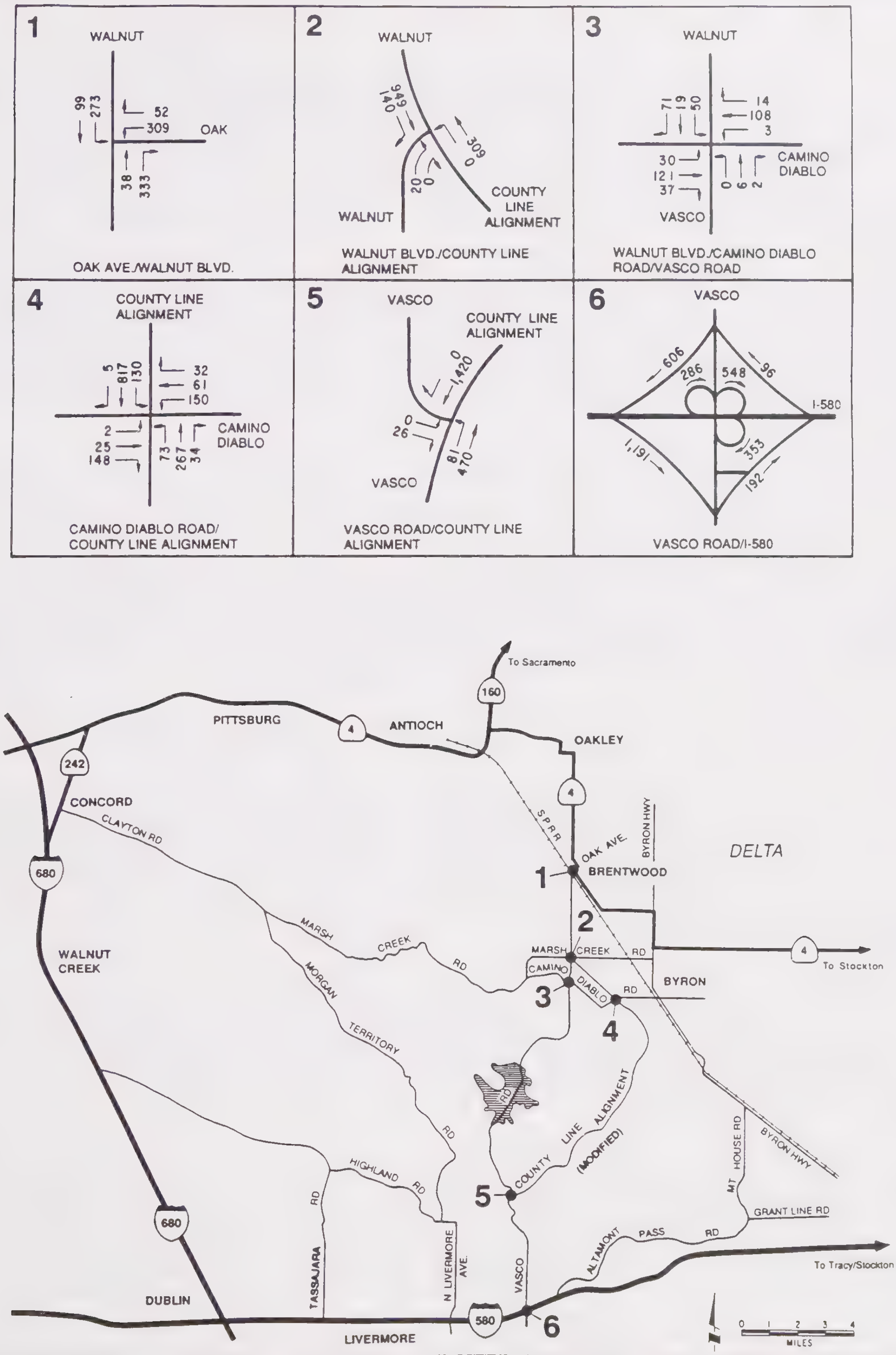


Figure 13-9. Los Vaqueros Reservoir Alternative (1995) A.M. Peak-Hour Traffic Volumes

County Line Alignment/Vasco Road Intersection. Construction-related traffic under this alternative would result in LOS E at this intersection, with an estimated reserve capacity of 93 because of heavy traffic from southbound Vasco Road (from the project area) to southbound County Line Alignment (Modified). Based on peak-hour traffic, this intersection does not meet signal warrants. Therefore, this impact would be less than significant. To further reduce this impact, an acceleration lane could be added for construction-related traffic making the right turn from southbound County Line Alignment (Modified) to southbound Vasco Road, and a left-turn lane could be provided on the northbound County Line Alignment (Modified) approach.

Traffic Safety Impacts. The traffic safety impacts of this alternative would be similar to the impacts identified for Existing Conditions. Traffic volumes would be slightly higher because of construction-related truck traffic that contributes to intersection congestion. Potential safety impacts of congested traffic conditions would be significant. To reduce these impacts to less-than-significant levels, the mitigation measures under Existing Conditions for critical intersection and roadway segments should be implemented.

Impacts of Transfer Facility, Intake Facility, and Pipeline Construction

Daily and peak-hour construction trips were estimated for each transfer facility site and associated electric transmission lines and pipelines. Construction of these facilities would not produce more than 50 peak-hour construction-related truck trips. Therefore, no significant impacts on intersection or roadway segment LOS would occur and no mitigation is required. However, significant construction impacts could occur because of construction vehicle trips on the primary facilities and access roads, including traffic delays on roadways affected directly by construction of pipelines. In general, construction-related traffic impacts would be concentrated in areas with relatively little access to construction sites, and would be dispersed in construction areas where a large number of access roads are available.

The significant impacts of transfer facility, intake facility, and pipeline construction are discussed below.

Rock Slough/Old River No. 1 Configuration. Construction of this configuration would depend on access from SR 4, Byron Highway, Armstrong Road, and Camino Diablo Road. Access for pipe delivery would be primarily from SR 4 and Byron Highway. In addition to access requirements, this pipeline alignment would be constructed across Byron Highway. Because this alignment crosses relatively few facilities, construction vehicle trips to and from the construction sites would be concentrated on these facilities.

Constructing this alternate project configuration could result in traffic delays on SR 4 and Byron Highway associated with construction truck turning movements from these facilities to construction site access roads. Turning movements from SR 4 and Byron Highway would require trucks to slow or stop on the primary facility to make the required right-hand or left-hand turning movements to construction site access roads.

Constructing the Old River No. 1 pipeline across Byron Highway could also contribute to traffic delays on Byron Highway, although this delay would be reduced by boring the pipeline under the facility. These traffic delays meet two of the criteria for significant impacts: construction delays on both facilities would occur for more than 1 week, and delays would occur on SR 4 that would have 1995 traffic volumes greater than 15,000 ADT. These temporary delays, therefore, would be significant impacts. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Rock Slough/Old River No. 2 Configuration. This configuration would result in construction delays and disruptions on each of the facilities identified above because of difficult truck turning movements from the primary facility to construction site access roads. Construction delays from trenching and laying pipe under roadways would also occur although pipelines would be bored under major facilities such as

SR 4 and Byron Highway. Pipeline construction could also result in adverse circulation problems near Discovery Bay. These construction delays meet two of the criteria for significant impacts: SR 4 would experience construction-related delays for more than 1 week, and traffic delays would affect facilities with greater than 15,000 ADT in 1995. These impacts would be significant. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Rock Slough/Old River No. 3 Configuration. Constructing this alternate configuration would result in construction delays and disruptions on each of the facilities identified above because of truck turning movements from Orwood Road to construction site access roads and because of pipeline construction under all of the listed roadways, except Orwood Road. This impact meets two of the criteria for significant impacts: Orwood Road would be subject to construction delays from truck traffic for more than 1 week, and construction delays would affect SR 4 with greater than 15,000 ADT in 1995. These impacts would be significant. To reduce these construction delay impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Rock Slough/Old River No. 4 Configuration. Constructing this alternate configuration would result in impacts similar to the impacts identified under the Rock Slough/ Old River No. 3 configuration. Construction delay impacts would be significant and could be reduced to less-than-significant levels by implementation of proper construction management techniques by CCWD.

Rock Slough/Old River No. 5 Configuration. Construction of this configuration would require access from SR 4, Byron Highway, Hoffman Lane, and Camino Diablo Road. Truck traffic for pipe delivery would occur primarily on SR 4 and Byron Highway. This pipeline alignment would require crossing Byron Highway. Because this alignment is near few facilities, its impacts would be concentrated on these few facilities and, therefore, would be more significant.

Pipeline construction would result in delays on SR 4, Byron Highway, and Camino Diablo Road because of truck turning movements from these facilities to construction site access roads. Construction delays could also occur at the Byron Highway construction site, although these delays would be reduced by boring the pipeline under the roadway. These impacts meet two of the criteria for significant impacts: construction delays would occur for more than 1 week, and construction delays would affect SR 4 with greater than 15,000 ADT in 1995. These impacts would be significant. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Rock Slough/Old River No. 6 Configuration. Constructing this alternate configuration would result in the same impacts as those identified under the Rock Slough/ Old River No. 5 configuration. The construction delay impacts would be significant. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Rock Slough/Clifton Court Forebay Configuration. Construction of this configuration would depend on access from Byron Highway, Armstrong Road, and Camino Diablo Road. Truck routes for pipe delivery would be primarily along Byron Highway and Camino Diablo Road. This pipeline alignment would also cross Byron Highway.

Constructing this configuration would result in construction delays on Byron Highway and Camino Diablo Road associated with turning movements from these facilities to construction site access roads. Constructing this pipeline across Byron Highway could also result in construction traffic delays, although this impact would be partially reduced by boring the pipeline under the roadway. This impact meets two of the criteria for significant impacts: delays would occur for more than 1 week, and detours at the Byron Highway construction site would be greater than 5 miles. These construction delays would be significant impacts. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Impacts of Recreation Traffic in 2025

The following summarizes the methodology for analyzing the impacts of recreation traffic in 2025 for the Los Vaqueros Reservoir Alternative. For a detailed discussion of methodologies and assumptions, see the Stage 2 EIR/EIS Technical Report (bound separately).

For this analysis, recreation-related traffic combined with peak weekday commute traffic was assumed to present a worst-case scenario. This peak weekday period was assumed to occur during the summer p.m. peak hour on a Friday, when recreation traffic going to the watershed would combine with p.m. peak commute traffic.

Impacts on P.M. Peak-Hour Traffic Conditions. Projected Los Vaqueros Reservoir Alternative p.m. peak-hour LOS for roadway segments are listed in Table 13-4 and traffic volumes are listed in Figure 13-10. During the p.m. peak hour, most of the roadway segments would operate at unacceptable LOS. The western Camino Diablo Road and Walnut Boulevard segments would operate at an acceptable LOS.

Under the Los Vaqueros Reservoir Alternative, no significant impacts were identified because traffic volume increase did not meet significance criteria.

Kellogg Reservoir Alternative

Impacts of Dam and Reservoir Construction

Impacts on A.M. Peak-Hour Traffic Conditions. The traffic impacts associated with construction of the Kellogg Reservoir Alternative dam and reservoir would be similar to those identified for the Los Vaqueros Reservoir Alternative (Table 13-3) because dam construction would occur in the Kellogg Creek watershed. The dam and reservoir construction period for the Kellogg Reservoir Alternative would be slightly longer than under the Los Vaqueros Reservoir Alternative. Construction vehicles would use the same roadways as described for the Los Vaqueros Reservoir Alternative and would, therefore, have an identical impact on a.m. peak-hour traffic conditions.

Impacts of Pipeline and Intake Facility Construction

Under this alternative, the construction-related traffic impacts of the Camino Diablo transfer facility and the Rock Slough/Old River No. 5 configuration would have less-than-significant impacts on roadway traffic volumes and LOS because construction-related truck traffic would not exceed 50 trips during the peak hour. However, pipeline and intake construction would result in traffic delays on SR 4, Byron Highway, and Camino Diablo Road. These construction delays would be significant impacts. To reduce these impacts to less-than-significant levels, the measures identified for the Rock Slough/Old River No. 5 configuration under the Los Vaqueros Reservoir Alternative should be implemented.

Impacts of Recreation in 2025

Impacts on P.M. Peak-Hour Traffic Conditions. The traffic-related impacts associated with recreation activities in 2025 under the Kellogg Reservoir Alternative would be similar to those of the Los Vaqueros Reservoir Alternative (Table 13-4). The recreation concept described for the Los Vaqueros Reservoir Alternative is assumed to also be implemented for the Kellogg Reservoir Alternative. Therefore, recreational traffic associated with this alternative would affect the same roadway segments as described under the Los Vaqueros Reservoir Alternative. Figure 13-8 shows the projected traffic volumes associated with this alternative.

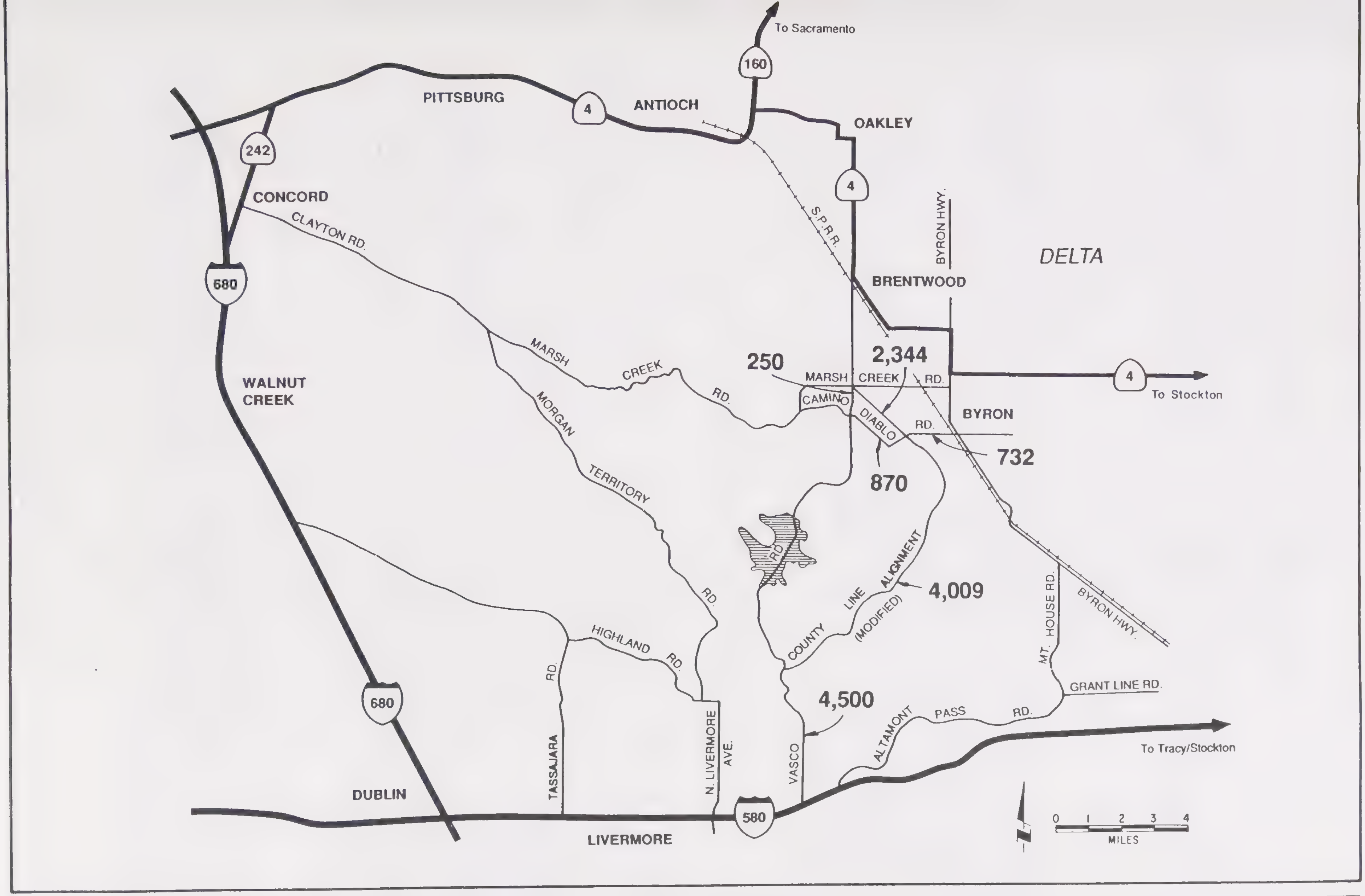


Figure 13-10. Los Vaqueros Reservoir Alternative (2025) P.M. Peak-Hour Traffic Volumes on Road Segments

Desalination/EBMUD Emergency Supply Alternative

Because this alternative would not involve use of watershed lands, no recreation development would occur. The methodologies used to identify significant impacts that would occur under this alternative are identical to those described under the Los Vaqueros Reservoir Alternative.

Impacts of Plant and Pipeline Construction

Construction of a desalination plant with appurtenant pipeline facilities would generate additional trips on local roadways, including SR 4, Cypress Road, and numerous roadways along the brine disposal pipeline. Because the pipeline included in this alternative would cross a large number of transportation facilities, thereby dispersing impacts, and because truck traffic would not exceed 50 trips during the peak hour, no significant impact would occur. No mitigation is required.

Construction of the desalination plant and associated pipelines would also result in delays on SR 4, and numerous other roadways, north through Pittsburg because of construction vehicle use of access roads that intersect with SR 4 and brine disposal pipeline construction along an extensive right-of-way north of SR 4. This impact meets two of the criteria for significant impacts: construction delays would occur for more than 1 week, and construction delays would affect SR 4 with greater than 15,000 ADT. These delay impacts would be significant. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

Middle River Intake/EBMUD Emergency Supply Alternative

Impacts of Pipeline and Intake Facility Construction

Construction of the Middle River Intake/EBMUD Emergency Supply Alternative would generate construction trips on local roadways, including SR 4, Byron Highway, Eden Plains Road, Sellers Avenue, Sunset Road, Walnut Boulevard, Lone Tree Way, and Empire Avenue. Because the pipeline crosses an extensive roadway network, the construction traffic impacts would be dispersed.

Construction of the pipelines, an intake facility, and appurtenant facilities would result in construction delays on SR 4, Byron Highway, and Walnut Boulevard because of construction-related truck use on access roads intersecting these facilities and pipeline construction at the northern extension of Byron Highway. This impact meets two of the criteria for significant impacts: construction delays would occur for more than 1 week, and detours would affect SR 4 with greater than 15,000 ADT. These impacts would be significant. To reduce these impacts to less-than-significant levels, CCWD should undertake proper construction management techniques.

MITIGATION MEASURES

This discussion identifies the mitigation measures required to reduce significant adverse impacts to less-than-significant levels. In many instances, the measures required under project alternative scenarios would be identical to the measures required under the No-Action Alternative. Therefore, mitigation measures identified for the project alternatives are those that would be required in addition to the measures required under the No-Action Alternative.

No-Action Alternative

As part of the Vasco Road and Utility Relocation Project EIR process, CCWD adopted the signalization of the County Line Alignment (Modified)/Camino Diablo Road intersection as a mitigation measure. The measures described below are additional measures that would be required to reduce impacts to less-than-significant levels.

Reservoir Alternative Baseline - Existing Conditions

The following is a discussion of mitigation measures necessary to reduce impacts projected under Existing Conditions with no reservoir to less-than-significant levels. The need for these measures results from projected increases in traffic volumes that are not related to project alternatives. Although the County Line Alignment (Modified) is assumed to be constructed, the projected traffic volumes are from regional growth and are not generated by this transportation improvement. Undertaking measures related to existing intersection operations would be the responsibility of Caltrans, Contra Costa and Alameda Counties, and the City of Livermore.

Each of these agencies, however, is short of funds for transportation system improvements. Therefore, many of the improvements probably would not be made before a reservoir project alternative would be implemented.

Impacts on A.M. Peak-Hour Traffic Conditions

Signalize the Oak Avenue/Walnut Boulevard Intersection. Contra Costa County should signalize this intersection to improve its LOS to acceptable levels.

Add a Right-Turn Lane to the Eastbound Approach of Camino Diablo Road. Contra Costa County should add a right-turn lane to the eastbound approach of Camino Diablo Road at its intersection with the County Line Alignment (Modified). This measure would improve intersection LOS to acceptable levels.

Impacts on P.M. Peak-Hour Traffic Conditions

Widen the County Line Alignment (Modified) to Four Lanes between Its Intersection with Vasco Road and Camino Diablo Road. Contra Costa County should widen the County Line Alignment (Modified) to four lanes. This measure would improve the LOS on this segment to acceptable levels.

Widen Vasco Road to Four Lanes between Its Intersection with the County Line Alignment (Modified) and I-580. Alameda County should widen this segment to four lanes to improve projected traffic conditions. This measure would improve the LOS on this segment to acceptable levels.

Reservoir Alternative Baseline - Future Conditions

This discussion identifies additional mitigation measures, beyond those described above under "Existing Conditions", that would be required to provide acceptable LOS conditions at critical facilities, based on projected 2025 traffic volumes and assuming no other traffic system improvements occur.

Impacts on A.M. Peak-Hour Traffic Conditions

Widen Camino Diablo Road to Four Lanes East of the County Line Alignment (Modified). Contra Costa County should widen this road segment to four lanes east of the County Line Alignment (Modified) to Byron Highway. This measure would improve the LOS on this segment to acceptable levels.

Widen the County Line Alignment (Modified) to Four Lanes between Walnut Boulevard and Camino Diablo Road. Contra Costa County should widen this road segment to four lanes. This measure would improve the LOS on this segment to acceptable levels.

Los Vaqueros Reservoir Alternative

The measures identified below are additional measures that would be needed to mitigate transportation impacts directly attributable to this alternative. These mitigation measures would be the responsibility of CCWD.

Impacts of Dam and Reservoir Construction on A.M. Peak-Hour Traffic Conditions

13-1: Install a Right-Turn Acceleration Lane from Southbound Vasco Road to Southbound County Line Alignment (Modified) and Add a Left-Turn Lane to the County Line Alignment/Vasco Road Intersection. Although this intersection would operate at an unacceptable LOS, the intersection does not meet signal warranty and this impact is, therefore, would be less than significant. To attain acceptable LOS levels, CCWD could install an acceleration lane for construction-related traffic making the right turn from southbound Vasco Road (north of the County Line Alignment intersection) to southbound Vasco Road south of the intersection. CCWD could also add a left-turn lane on northbound Vasco Road at the intersection approach. This measure would improve the LOS at this intersection to acceptable levels.

Impacts of Transfer Facility, Intake Facility, and Pipeline Construction

Rock Slough/Old River No. 1 Configuration

13-2: Implement Proper Construction Management Techniquies. CCWD should implement appropriate construction management at construction traffic access road locations including but not limited to:

- maintaining proper signage,
- restricting construction truck traffic on SR 4 to off-peak hours, and
- limiting construction traffic on day when fog severely limits visibility.

Staging areas for trucks and construction equipment should be provided along all construction site access roads to facilitate removal of construction equipment from the traffic flow. These measures would reduce traffic delays to less-than-significant levels.

Rock Slough/Old River No. 2 Configuration. CCWD should implement mitigation measure 13-2 identified above for the Rock Slough/Old River No. 1 configuration. This measure would reduce traffic delays to less-than-significant levels.

Rock Slough/Old River No. 3 Configuration. CCWD should implement mitigation measure 13-2 identified above for the Rock Slough/Old River No. 1 configuration. This measure would reduce traffic delays to less-than-significant levels.

Rock Slough/Old River No. 4 Configuration. CCWD should implement mitigation measure 13-2 identified above for the Rock Slough/Old River No. 1 configuration. This measure would reduce traffic delays to less-than-significant levels.

Rock Slough/Old River No. 5 Configuration. CCWD should implement mitigation measure 13-2 identified above for the Rock Slough/Old River No. 1 configuration. This measure would reduce traffic delays to less-than-significant levels.

Rock Slough/Old River No. 6 Configuration. CCWD should implement mitigation measure 13-2 identified below for the Rock Slough/Old River No. 1 configuration. This measure would reduce traffic delays to less-than-significant levels.

Rock Slough/Clifton Court Forebay Configuration

Implement Proper Construction Management Techniques. Implementing measure 13-2 would reduce impacts of construction traffic on major thoroughfares to less-than-significant levels.

13-3: Construct a Detour on Byron Highway at the Clifton Court Forebay Pipeline Construction Site. CCWD should construct a two-lane detour, to be used by through-traffic, at the pipeline crossing at Byron Highway. This measure would reduce traffic delays to less-than-significant levels.

Impacts of Recreation in 2025 on P.M. Peak-Hour Traffic Conditions

No additional measures would be required under this alternative beyond those identified for the Reservoir Alternative Baseline - Future Conditions.

Kellogg Reservoir Alternative

The measures identified below are additional measures that would be needed to mitigate transportation impacts directly attributable to this alternative. These measures would be the responsibility of CCWD.

Impacts of Dam and Reservoir Construction on A.M. Peak-Hour Conditions

Install a Right-Turn Acceleration Lane from Southbound Vasco Road to Southbound County Line Alignment (Modified) and Add a Left-Turn Lane to the County Line Alignment/Vasco Road Intersection. Although impacts at this intersection would be less than significant, CCWD could implement mitigation measure 13-1 to achieve an acceptable LOS.

Impacts of Transfer Facility, Intake Facility, and Pipeline Construction

Rock Slough/Old River No. 5 Configuration. CCWD should implement mitigation measure 13-2 identified above for the Los Vaqueros Reservoir Alternative. These measures would reduce delays to less-than-significant levels.

Desalination/EBMUD Emergency Supply Alternative

Impacts of Plant and Pipeline/Intake Alignment Construction

Implement Proper Construction Management Techniques. CCWD should implement mitigation measure 13-2 identified above for the Los Vaqueros Reservoir Alternative. These measures would reduce delays to less-than-significant levels.

Middle River Intake/EBMUD Emergency Supply Alternative

Impacts of Pipeline/Intake Alignment Construction

Implement Proper Construction Management Techniques. CCWD should implement mitigation measure 13-2 identified above for the Los Vaqueros Reservoir Alternative. These measures would reduce delays to less-than-significant levels.

Chapter 14. Air Quality

AFFECTED ENVIRONMENT

Primary Pollutants, Secondary Pollutants, and Pollutant Precursors

Air pollutants are often characterized as "primary" or "secondary" pollutants. Primary pollutants are those emitted directly into the atmosphere (such as carbon monoxide [CO], sulfur dioxide, lead particulates, and hydrogen sulfide). Secondary pollutants are those (such as ozone, nitrogen dioxide, and sulfate particles) formed through chemical reactions in the atmosphere; these chemical reactions usually involve primary pollutants, normal constituents of the atmosphere, and other secondary pollutants.

Those compounds that react to form secondary pollutants are often referred to as reactive pollutants, pollutant precursors, or precursor emission products. Some air pollutants (such as many organic gases and suspended particulate matter) are a combination of primary and secondary pollutants.

The distinction between primary and secondary pollutants is more than a matter of semantics; important air quality management implications are also involved. The ambient concentration of primary pollutants depends on the spatial concentration of the emission sources, the rate of pollutant emissions, and the degree to which the emitted pollutants are dispersed or removed from the atmosphere between the emission source and the location of interest.

Ambient Air Quality Standards

Both the State of California and the federal government have established ambient air quality standards for several different pollutants (Table 14-1). For some pollutants, separate standards have been set for different time periods. Most standards have been set to protect public health. For some pollutants, standards have been based on other values (such as protection of crops, protection of materials, or avoidance of nuisance conditions).

Existing Air Quality Conditions

Various locations in the San Francisco Bay Area violate federal and state air quality standards for ozone, particulate matter, and CO. Occasional violations of the federal or state ozone standards occur in most parts of the Bay Area. Violations of the federal and state CO standards occur primarily in the San Francisco, San Jose, and Vallejo areas. The federal standard for particulate matter smaller than or equal to 10 microns in diameter (PM_{10}) is not being exceeded in the Bay Area, but the more stringent state PM_{10} standards are violated at several monitoring stations.

No air quality monitoring stations are located within the Kellogg Creek watershed. Existing monitoring stations in Livermore, Concord, Pittsburg, and Bethel Island provide a general indication of current air quality conditions. Table 14-2 summarizes recent CO and ozone data from the study area vicinity. CO data from the Bethel Island station are more representative of conditions in the Kellogg Creek

Table 14-1. Ambient Air Quality Standards Applicable in California

Pollutant	Symbol	Averaging Time	Standard, as Parts per Million		Standard, as Micrograms per Cubic Meter		Violation Criteria	
			California	Federal	California	Federal	California	Federal
Ozone	O_3	1 hour	0.09	0.12	180	235	If exceeded	If exceeded on more than 3 days in 3 years
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000		
(Lake Tahoe only)		8 hours	6	--	7,000	--		
Nitrogen dioxide	NO_2	Annual average	--	0.053	--	100	if exceeded	If exceeded
		1 hour	0.25	--	470	--		
Sulfur dioxide	SO_2	Annual average	--	0.03	--	80	If exceeded	If exceeded
		24 hours	0.05	0.14	131	365		If exceeded on more than 1 day per year
		1 hour	0.25	--	655	--		
Hydrogen sulfide	H_2S	1 hour	0.03	--	42	--	If equaled or exceeded	
Vinyl chloride	C_2H_3Cl	24 hours	0.010	--	26	--	If equaled or exceeded	
Particulate matter, 10 microns or less	PM_{10}	Annual geometric mean	--	--	30	--	If exceeded	
		Annual arithmetic mean	--	--	--	50		If exceeded
		24 hours	--	--	50	150		If exceeded on more than 1 day per year
Sulfate particles	SO_4	24 hours	--	--	25	--	If equaled or exceeded	
Lead particles	Pb	Calendar quarter	--	--	--	1.5	If equaled or exceeded	If exceeded on more than 1 day per year
		30 days	--	--	1.5	--		

Notes: All standards are based on measurements at 25° C and 1 atmosphere pressure.
National standards shown are the primary (health effects) standards.
The California 24-hour standard for SO_2 applies only when state 1-hour O_3 or 24-hour PM_{10} standards are being violated concurrently.

Table 14-2. Summary of Recent Carbon Monoxide and Ozone Monitoring Data for the Study Area

		Carbon Monoxide					Ozone				
Monitoring Station	Parameter	1985	1986	1987	1988	1989	1985	1986	1987	1988	1989
Livermore - Old 1st Street	Peak 1-hour value (ppm)	8.00	10.00	10.00	8.00	10.00	0.15	0.14	0.15	0.15	0.14
	Peak 8-hour value (ppm)	5.30	4.90	3.60	4.40	4.40	0.00	0.00	0.00	0.00	0.00
	Days above federal standard	0	0	0	0	0	4	3	3	4	2
	Days above state standard	0	0	0	0	0	21	20	10	21	9
Bethel Island Road	Peak 1-hour value (ppm)	8.00	2.00	3.00	3.00	3.00	0.13	0.12	0.12	0.11	0.11
	Peak 8-hour value (ppm)	1.30	1.30	2.30	2.30	2.10	0.00	0.00	0.00	0.00	0.00
	Days above federal standard	0	0	0	0	0	2	0	0	0	0
	Days above state standard	0	0	0	0	0	8	8	14	7	11
Concord - Treat Boulevard	Peak 1-hour value (ppm)	11.00	10.00	12.00	15.00	10.00	0.15	0.12	0.14	0.14	0.11
	Peak 8-hour value (ppm)	5.30	5.60	5.50	6.60	5.60	0.00	0.00	0.00	0.00	0.00
	Days above federal standard	0	0	0	0	0	1	0	3	1	0
	Days above state standard	0	0	0	0	0	10	5	20	10	6
Pittsburg	Peak 1-hour value (ppm)	9.00	9.00	8.00	8.00	12.00	0.14	0.10	0.15	0.12	0.11
	Peak 8-hour value (ppm)	3.80	5.60	5.30	5.10	4.80	0.00	0.00	0.00	0.00	0.00
	Days above federal standard	0	0	0	0	0	1	0	2	0	0
	Days above state standard	0	0	0	0	0	3	1	14	8	5

Notes: NA = not applicable.
ppm = parts per million by volume.
Federal 1-hour CO standard is 35 ppm; state 1-hour CO standard is 20 ppm.
Federal 8-hour CO standard is 9 ppm; state 8-hour CO standard is 9.0 ppm.
Federal 1-hour ozone standard is 0.12 ppm; state 1-hour ozone standard is 0.09 ppm.

Source: California Air Quality Data, Volumes XVII-XXI (Annual Summaries).

watershed than are data from the other monitoring stations. Ozone data from the Livermore and Concord monitoring stations are generally representative of conditions in the Kellogg Creek watershed.

There is no indication from the data in Table 14-2 of any existing CO problems in or near the project study area. The data in Table 14-2 suggest that occasional violations of the federal and state ozone standards occur throughout the project region.

Table 14-3 summarizes particulate matter monitoring data from the Livermore, Concord, Pittsburg, and Bethel Island monitoring stations. No violations of the current federal PM_{10} standards have been detected by monitoring stations surrounding the project study area. Violations of the more stringent state PM_{10} standards are recorded about 10% of the time at most monitoring stations. The data in Table 14-3 suggest that occasional violations of the state PM_{10} standards occur in the project study area.

Air Quality Management Programs

The California Clean Air Act requires preparation of an air quality attainment plan for areas that violate state air quality standards for CO, sulfur dioxide, nitrogen dioxide, or ozone. No locally prepared attainment plans are required for areas that violate the state PM_{10} standards. PM_{10} attainment issues are being addressed by the California Air Resources Board.

The Bay Area Air Quality Management District (BAAQMD) recently released a draft air quality management plan prepared in cooperation with ABAG and the Metropolitan Transportation Commission. The draft plan addresses CO and ozone problems in the Bay Area, but focuses most attention on ozone problems.

The draft plan projects attainment of federal and state CO standards by 1994 for most portions of the Bay Area, although occasional violations of the CO standards may continue to occur in the San Jose and Vallejo areas. The draft plan projects continued violations of the state ozone standard beyond 1997, thus classifying the Bay Area as a "severe" ozone nonattainment area. Severe nonattainment areas must implement numerous measures.

ENVIRONMENTAL CONSEQUENCES

Criteria for Conclusions of Significance

Significance criteria for physical air quality impact issues is dictated largely by the technical procedures used for the impact assessment. When dispersion modeling analyses are performed, the most appropriate impact criteria are the federal or state ambient air quality standards. When dispersion modeling is not performed, impact significance is evaluated according to the appropriate emission thresholds.

Physical air quality impacts analyzed in this chapter focus on three pollutant categories: CO, ozone precursors, and PM_{10}. CO vehicle emissions impacts are evaluated in two ways: construction-related CO impacts within the Kellogg Creek watershed are expressed as emission quantities (e.g., pounds per day) and recreation-related impacts are expressed as ambient concentrations using dispersion modeling.

The significance of construction-related CO impacts within the watershed is determined by qualitatively evaluating total emission amounts compared with the geographic area in which the effects would occur and the existing CO conditions. This screening evaluation eliminated the need for dispersion modeling in areas where construction emissions would be dispersed over a large area.

Table 14-3. Summary of Recent Total Suspended Particulate Matter and Inhalable Particulate Matter Monitoring Data for the Study Area

Monitoring Station	Parameter	Total Suspended Particulate Matter					Enhalable Particulate Matter				
		1985	1986	1987	1988	1989	1985	1986	1987	1988	1989
Livermore - Old 1st Street	Peak 24-hour value (ug/m^3)	117	144	121	111	106	ND	84	87	69	108
	Annual geometric mean (ug/m^3)	52.8	45.9	50.3	46.9	42.8	ND	27.8	26.0	29.4	32.7
	Annual arithmetic mean (ug/m^3)	ND	ND	ND	ND	ND	ND	30.7	30.0	33.3	37.4
	Number of 24-hour samples	61	61	60	61	61	ND	46	50	60	61
	Percent of samples above federal standard	0.0	0.0	0.0	0.0	0.0	ND	0.0	0.0	0.0	0.0
	Percent of samples above state standard	6.6	8.2	6.7	6.6	1.6	ND	10.9	10.0	13.3	21.3
Bethel Island Road	Peak 24-hour value (ug/m^3)	139	128	128	139	136	71	80	95	82	104
	Annual geometric mean (ug/m^3)	52.2	40.8	48.2	48.4	41.5	29.6	26.0	24.0	27.8	25.7
	Annual arithmetic mean (ug/m^3)	ND	ND	ND	ND	ND	33.4	28.6	28.4	32.6	29.0
	Number of 24-hour samples	32	46	60	61	61	19	41	58	35	61
	Percent of samples above federal standard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Percent of samples above state standard	6.3	4.3	5.0	6.6	4.9	10.5	7.3	8.6	20.0	11.5
Concord - Treat Boulevard	Peak 24-hour value (ug/m^3)	131	96	135	121	119	ND	86	85	86	101
	Annual geometric mean (ug/m^3)	43.2	38.8	47.8	46.4	42.6	ND	23.0	26.1	20.5	25.8
	Annual arithmetic mean (ug/m^3)	ND	ND	ND	ND	ND	ND	26.6	29.2	24.7	30.5
	Number of 24-hour samples	61	61	61	61	61	ND	44	58	34	48
	Percent of samples above federal standard	0.0	0.0	0.0	0.0	0.0	ND	0.0	0.0	0.0	0.0
	Percent of samples above state standard	3.3	0.0	4.9	8.2	3.3	ND	9.1	10.3	11.8	10.4
Pittsburg	Peak 24-hour value (ug/m^3)	132	102	146	229	248	ND	ND	ND	ND	ND
	Annual geometric mean (ug/m^3)	58.4	51.1	62.9	64.0	74.3	ND	ND	ND	ND	ND
	Annual arithmetic mean (ug/m^3)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Number of 24-hour samples	61	30	50	61	61	ND	ND	ND	ND	ND
	Percent of samples above federal standard	0.0	0.0	0.0	0.0	0.0	ND	ND	ND	ND	ND
	Percent of samples above state standard	9.8	3.3	18.0	21.3	27.9	ND	ND	ND	ND	ND

Notes: ND = no data.
ug/m^3 = micrograms per cubic meter.
Previous federal total suspended particulate matter (TSP) standards are 75 ug/m^3, annual geometric mean; 260 ug/m^3, 24-hour average.
Previous state TSP standards are 60 ug/m^3, annual geometric mean; 100 ug/m^3, 24-hour average.
Current federal PM_{10} standards are 50 ug/m^3, annual arithmetic mean; 150 ug/m^3, 24-hour average.
Current state PM_{10} standards are 30 ug/m^3, annual geometric mean; 50 ug/m^3, 24-hour average.

Source: California Air Quality Data, Volumes XVII-XXI (Annual Summaries).

The significance of recreation-related CO impacts are determined by comparing project CO levels from recreation traffic along roadways at 39 locations with the federal and state ambient air quality standards (Table 14-1).

CO dispersion modeling has not been performed for construction-related impacts along truck routes because the peak-hour traffic volumes associated with construction trips would be less than 50 truck trips for all of the project alternatives and monitoring data indicate that the project region does not have CO pollution problems. The project alternatives' low-volume truck traffic would not appreciably affect localized CO concentrations along any of the truck routes. Therefore, this effect would be less than significant and is not considered in this evaluation.

PM_{10} and ozone precursor issues have been evaluated based on estimated emission quantities. BAAQMD does not have any regulatory impact significance thresholds intended for application to construction activity or vehicle travel. However, BAAQMD regulations contain thresholds for judging significance of industrial-source emissions. BAAQMD requires industrial sources to install best available control technology (BACT) if emissions on the maximum operating day would exceed:

- 150 pounds per day of total or reactive organic compounds,
- 150 pounds per day of nitrogen oxides,
- 150 pounds per day of sulfur oxides, or
- 80 pounds per day of PM_{10}.

These stationary-source BACT threshold values have been used in this evaluation to judge the significance of construction-period ozone precursor and PM_{10} emissions and ozone precursor emissions from recreation vehicle travel to the Kellogg Creek watershed.

No-Action Alternative

Under the No-Action Alternative, CCWD would undertake various improvements to the existing water delivery system. Various segments of the Contra Costa Canal would be enlarged to provide increased capacity. In addition, four existing pumping plants would be replaced. These system expansions and modifications would entail short-term construction-related air quality impacts (dust and construction equipment exhaust emissions). The magnitude of these construction impacts has not been quantified, but it would be relatively minor. Air quality impacts under this alternative would be less than significant. No mitigation is required.

Los Vaqueros Reservoir Alternative

The Los Vaqueros Reservoir Alternative would entail significant construction activity over a 2-year period. Construction activity would be focused on the reservoir area and along one of seven alternate water conveyance pipeline alignments.

Because the Los Vaqueros Reservoir Alternative consists of several project components that are separated by a large geographic area, construction-related air quality impacts are identified individually for each project component. When impacts of the project components related to regional issues, ozone precursors and PM_{10} emissions, would occur simultaneously, the additive effect of project components is considered in determining impact significance.

Impacts of Dam and Reservoir Construction

Site clearing, excavation activities, and construction of the dam and associated facilities in the Kellogg Creek watershed would generate substantial quantities of dust and equipment exhaust emissions. The nature and extent of construction activities would vary considerably throughout the construction period. Table 14-4 presents an estimate of typical dust and equipment exhaust emissions that would occur during site clearing and excavation in the watershed. Additional construction period emissions (primarily dust) would occur during removal of excavation spoil and during placement of material used to construct the dam and associated facilities. The emission estimates in Table 14-4 recognize that the scale of construction activity would preclude a high level of effectiveness for dust control programs.

The CO emissions associated with construction of the dam and reservoir would be slightly more than 700 pounds per day. This emission amount would represent a minor contribution to construction site CO levels because CO emissions would be emitted fairly evenly during construction hours and would be dispersed through a large construction site. Because the project area does not currently exhibit CO pollution problems, this minor contribution would be a less-than significant impact. No mitigation is required.

The construction-period ozone precursor and PM_{10} emissions that would result from construction activities in the watershed exceed the 150-pounds-per-day BACT thresholds. Table 14-4 indicates that nitrogen and sulfur oxide emissions would exceed the BACT threshold values.

Dam and reservoir construction would also exceed the BACT thresholds for fugitive dust emissions and would likely produce localized violations of the federal and state PM_{10} standards. Because the localized PM_{10} emissions would greatly exceed the PM_{10} threshold of 80 pounds per day, this impact would be substantial. However, public exposure to these localized PM_{10} violations would be minimal because no residences would be located near the construction site and public access would be limited in the watershed area during the 23-month construction period. Therefore, the construction site PM_{10} violations would probably not substantially affect air quality conditions for most project area residents.

Impacts of Los Vaqueros Pipeline Construction

Construction of the 12-mile-long Los Vaqueros pipeline would involve a minor amount of site disturbance along the pipeline corridor. The major air quality impact associated with construction of the transfer pipeline would be PM_{10} emissions associated with removal of excavation spoil and placement of pipeline trench fill material. Spoil and fill material transport is estimated to require 132 truck loads per day, resulting in 41 pounds per day of PM_{10} emissions during loading and unloading operations. This amount of PM_{10} emissions would be within the BACT threshold value. This incremental project component impact would represent a minor, temporary contribution to localized PM_{10} emissions that alone would not substantially affect residences near the alignment.

Construction of the Los Vaqueros pipeline would also generate minor amounts of ozone precursor emissions from construction vehicles that alone would not substantially contribute to regional ozone conditions.

Impacts for Alternate Pipeline and Intake Configuration Construction

Six alternate intake facilities and associated water conveyance pipelines are being considered for the Los Vaqueros Reservoir Alternative. Construction of intake facilities, transfer reservoirs, pumping plants, associated electric transmission lines, and transfer pipelines would result in generally similar quantities of emissions on a daily basis although the duration of the construction period would differ somewhat among alternate water conveyance pipeline alignments. These emissions are estimated to range between 28 and 44 pounds per day. Incrementally, these emissions represent minor contributions to localized PM_{10} and regional ozone precursor emissions.

Table 14-4. Los Vaqueros Reservoir Area Construction Period Emissions

Emission Source	Typical Construction Period Emissions during Major Site Disturbance Activities (pounds per day)				
	TOG	CO	NO_x	PM_{10}	SO_x
Construction vehicle exhaust emissions	103	728	1,616	118	170
PM_{10} fugitive dust from vehicle activity	0	0	0	2,888	0
Removal of excavation spoil	0	0	0	93	0
Placement of rock materials	0	0	0	4	0
Placement of core and shell materials	0	0	0	114	0
Total daily emissions	103	728	1,616	3,217	170

Notes: Emission rate data and equations from U.S. Environmental Protection Agency 1985a, 1985b (Sections 11.2.4, II-7, 8.24, and 11.2.3).

TOG = total organic compounds.
CO = carbon monoxide.
NO_x = oxides of nitrogen.
PM_{10} = particulate matter 10 microns or less in diameter.
SO_x = sulfur oxides.

Construction vehicle activity assumes 100 acres actively disturbed, 35% soil PM_{10} content, and 25% emission control effectiveness.

Excavation spoil removal assumes 301 20-ton truck loads per day.

Placement of rock materials assumes 87 20-ton truck loads per day.

Placement of core and shell materials assumes 371 20-ton truck loads per day.

Impacts of Vasco Road and Utility Relocations

The air quality impacts of the proposed relocation of Vasco Road and the utility facilities were fully analyzed in the Vasco Road and Utility Relocation Project EIR. Significant impacts from increased levels of dust during the construction period were identified. CCWD adopted mitigation measures involving implementing dust control measures during and after construction that would reduce these individual impacts to less-than-significant levels. Because construction of the County Line Alignment (Modified) and utility facilities would generally be complete before substantial construction of other project components began, it would not contribute to the simultaneous impacts discussed below.

Conclusions of Significance for Simultaneous Construction-Period Fugitive Dust and Ozone Precursor Emissions

Construction of project components under the Los Vaqueros Reservoir Alternative would occur concurrently, thus resulting in additive PM_{10} and ozone precursor emission impacts. Depending on the alternate pipeline and intake configuration that is selected, cumulative construction-period PM_{10} emissions would average 3,285-3,300 pounds per day. This total project alternative PM_{10} emission would substantially exceed the BACT threshold value of 80 pounds per day and would probably result in violations of the state PM_{10} standards. Although public exposure to localized violations of PM_{10} standards would be minimal because the project construction sites are generally unpopulated, and although the impact would be temporary, it would be significant and unavoidable. No mitigation is available to reduce this impact to a less-than-significant level.

Although this impact would be temporary, simultaneous ozone precursor emissions under this alternative also would exceed the BACT threshold value of 150 pounds per day, thus significantly contributing to regional ozone pollution problems. This impact would be significant and unavoidable. No mitigation is available to reduce this impact to a less-than-significant level.

Impacts of Recreation-Related Vehicle Emissions Regional Air Quality

Vehicle travel associated with summer recreational activities at the Los Vaqueros Reservoir would generate additional ozone precursor emissions in the region. The draft recreation plan for the Los Vaqueros Reservoir estimates a design capacity of 5,300-9,500 visitors per day depending on the specific recreational facilities provided (Jones & Stokes Associates 1991e). Most recreation use would be day use rather than overnight use. Design capacity use levels are expected to occur during summer holiday periods. Typical summer weekend use levels are expected to be well below capacity levels. Most recreational facilities would not be constructed until after the reservoir is completed. Consequently, recreational use levels approaching the design capacity levels would not occur until 2025.

Assuming a range of travel times to the Los Vaqueros Reservoir and an average vehicle occupancy of 2.8 people during a peak summer holiday, use would generate about 3,790-6,790 vehicle trips per day and 136,200-244,100 vehicle miles of travel per day. Based on future vehicle emission rates, vehicle travel associated with summer holiday recreational use would generate 100-180 pounds per day of reactive organic compound emissions and 254-455 pounds per day of nitrogen oxide emissions.

Vehicle emissions associated with peak summer recreational use of the Los Vaqueros Reservoir represent a significant and unavoidable air quality impact of the project. No mitigation is available to reduce this impact to a less-than-significant level.

Impacts of Recreation on Localized CO Problems

Recreational traffic to and from the Kellogg Creek watershed would increase traffic volumes on nearby roadways. The potential for localized CO problems on these roadways was evaluated with the CALINE4 dispersion model (Benson 1989) at 39 specific locations (receptors). Modeling of peak-hour traffic under the No-Action Alternative and Los Vaqueros Reservoir Alternative conditions showed that project-related traffic would increase CO levels by less than 0.5 part per million (ppm). The highest predicted 1-hour CO level was 6.2 ppm at a receptor location near the Vasco Road/I-580 interchange under both no-action and project conditions. This CO concentration is well below the state 1-hour standard of 20 ppm. Therefore, under this alternative, recreation traffic would have a less-than-significant impact on localized CO levels. No mitigation is required.

Consistency with the Regional Air Quality Plan

The recently released clean air plan for the Bay Area (Bay Area Air Quality Management District 1991) is based on population, housing, and land use projections prepared by ABAG. Water demand forecasts used by CCWD are based on city and county land use plans that are generally consistent with the forecasts used for the BAAQMD clean air plan. Thus, the growth assumptions that underlie the Los Vaqueros Reservoir Alternative are consistent with the growth assumptions used for the regional air quality plan. This impact would be less than significant. No mitigation is required.

The draft clean air plan identifies eight programs of new or improved regulations and policies. Some of these programs have general relevance to CCWD facilities and operations, although none of the proposed measures have a major bearing on the design or operation of the Los Vaqueros Reservoir. Maintenance activities at CCWD facilities would have to comply with existing and future BAAQMD rules concerning coating compounds (e.g., paints and varnishes) and solvents. Backup generators and similar equipment at CCWD pumping plants would have to comply with BAAQMD rules concerning stationary combustion equipment and fuel storage facilities. The recommended tram shuttle system for recreational users at the Los Vaqueros Reservoir may be subject to future BAAQMD rules concerning vehicle fleet operations.

Kellogg Reservoir Alternative

The Kellogg Reservoir Alternative would entail significant construction activity over a 3-year period. Impacts associated with construction of the Los Vaqueros pipeline, the pipeline and intake configuration, recreation-related vehicle traffic, localized CO problems, and consistency with regional air quality plans are identical to those described above for the Los Vaqueros Reservoir Alternative.

Impacts of Dam and Reservoir Construction

The Kellogg Reservoir Alternative dam and reservoir construction emissions would result in impacts similar to those identified for the Los Vaqueros Reservoir Alternative. Table 14-5 presents an estimate of typical dust and equipment exhaust emissions during site clearing and excavation in the reservoir area. Additional construction-period emissions (primarily dust) would occur during removal of excavation spoil and during placement of material used to construct the dam and associated facilities. The emission estimates in Table 14-5 recognize that the scale of construction activity would preclude a high level of effectiveness for dust control programs. CO emissions would represent a minor contribution to localized CO levels. This impact would be less than significant. No mitigation is required.

Ozone precursor and PM_{10} emissions would exceed the BACT threshold values and contribute substantially to regional ozone pollution problems and localized fugitive dust emissions.

Table 14-5. Kellogg Reservoir Area Construction-Period Emissions

Emission Source	Typical Construction Period Emissions during Major Site Disturbance Activities (pounds per day)				
	TOG	CO	NO_x	PM_{10}	SO_x
Construction vehicle exhaust emissions	159	1,192	2,709	183	284
PM_{10} fugitive dust from vehicle activity	0	0	0	2,888	0
Removal of excavation spoil	0	0	0	44	0
Placement of rock materials	0	0	0	5	0
Placement of core and shell materials	0	0	0	205	0
Total daily emissions	159	1,192	2,709	3,325	284

Notes: Emission rate data and equations from U.S. Environmental Protection Agency 1985a, 1985b (Sections 11.2.4, II-7, 8.24, and 11.2.3).

TOG = total organic compounds.
CO = carbon monoxide.
NO_x = oxides of nitrogen.
PM_{10} = particulate matter 10 microns or less in diameter.
SO_x = sulfur oxides.

Construction vehicle activity assumes 100 acres actively disturbed, 35% soil PM_{10} content, and 25% emission control effectiveness.

Excavation spoil removal assumes 301 20-ton truck loads per day.

Placement of rock materials assumes 87 20-ton truck loads per day.

Placement of core and shell materials assumes 371 20-ton truck loads per day.

Conclusions of Significance for Simultaneous Construction-Period Fugitive Dust and Ozone Precursor Emissions

Simultaneous construction of project components under the Kellogg Reservoir Alternative would result in additive PM_{10} and ozone precursor emission impacts. Construction-period PM_{10} emissions would average approximately 3,400 pounds per day. This emission total would exceed the BACT emission threshold value for PM_{10} and would probably result in violations of the state PM_{10} standards. This impact would be significant and unavoidable. No mitigation is available to reduce this impact to a less-than-significant level.

Simultaneous project ozone precursor emissions also would exceed the BACT emission threshold value of 150 pounds per day. This impact would be significant and unavoidable. No mitigation is available to reduce this impact to a less-than-significant level.

Desalination/EBMUD Emergency Supply Alternative

Impacts of Dust from Construction Activities

Construction of a desalination plant, pumping plant, brine disposal pipeline, and pipeline facilities plus EBMUD intertie facilities would entail a moderate amount of excavation and pipeline trench filling. Construction would entail about 162 truck loads per day for removal of excavation spoil and placement of pipeline trench fill material. Loading and unloading of spoil and fill material would generate about 50 pounds per day of PM_{10} emissions. Incrementally, this quantity of emissions represents a less-than-significant air quality impact.

Consistency with the Regional Air Quality Plan

Implementation of this alternative would be consistent with the regional air quality plan for the same reasons identified for the Los Vaqueros Reservoir Alternative. Therefore, no impacts would result and no mitigation is required.

Middle River Intake/EBMUD Emergency Supply Alternative

Impacts of Dust from Construction Activities

Construction of a new water intake, pumping plant, and pipeline facilities plus EBMUD intertie facilities would entail a moderate amount of excavation and pipeline trench filling. Construction would entail about 175 truck loads per day for removal of excavation spoil and placement of pipeline trench fill material. Loading and unloading of spoil and fill material would generate about 54 pounds per day of PM_{10} emissions. Incrementally, this quantity of emissions represents a less-than-significant air quality impact. No mitigation is required.

Consistency with the Regional Air Quality Plan

Implementation of this alternative would be consistent with the regional air quality plan for the same reasons identified for the Los Vaqueros Reservoir Alternative. Therefore, no impacts would result and no mitigation is required.

MITIGATION MEASURES

Los Vaqueros Reservoir Alternative

Impacts of Simultaneous Construction-Period Fugitive Dust and Ozone Precursor Emissions

No mitigation is available to reduce these construction-related air quality impacts to less-than-significant levels.

Impacts of Recreation-Related Vehicle Emissions on Regional Air Quality

No mitigation is available to reduce this impact to a less-than-significant level.

14-1: Encourage Extension of Public Transit and Investigate Use of Low-Emission Shuttle. To partially reduce this impact, CCWD could encourage extension of a public transit system to the watershed boundary and could investigate use of low emission vehicles (e.g., methanol, propane, natural gas, or electric vehicles) for the proposed shuttle system. These measures would slightly reduce recreation-related emissions of ozone precursors and would be consistent with air quality management programs in the Bay Area Clean Air Plan.

Kellogg Reservoir Alternative

Impacts of Cumulative Construction-Period Fugitive Dust and Ozone Precursor Emissions

No mitigation is available to reduce these construction-related air quality impacts to less-than-significant levels.

Impacts of Recreation-Related Vehicle Emissions on Regional Air Quality

No mitigation is available to reduce this impact to a less-than-significant level.

As identified for the Los Vaqueros Reservoir Alternative, to partially reduce this impact CCWD could encourage extension of a public transit system to the watershed boundary and could investigate use of low emission vehicles (e.g., methanol, propane, natural gas, or electric vehicles) for the proposed shuttle system. These measures would slightly reduce recreation-related emissions of ozone precursors and would be consistent with air quality management programs in the Bay Area Clean Air Plan.

All Other Alternatives

No mitigation is required.

Chapter 15. Noise

AFFECTED ENVIRONMENT

Noise Descriptor Equivalencies

The average noise exposure value at a site calculated from measurements taken over a given 24-hour period (L_{dn}) will be slightly lower than the community noise equivalent level (CNEL) value calculated over the same period. Except in situations where unusually high evening noise levels occur, the CNEL descriptor will be within 1.5 decibel (dB) of the L_{dn} descriptor for the same set of noise measurements.

In terms of traffic-related noise, the relationship between peak-hour equivalent noise level (L_{eq}) values and associated L_{dn} values depends on the distribution of traffic over the entire day. There is no precise way to convert a peak-hour L_{eq} value to an L_{dn} value. In urban areas near heavy traffic, the peak-hour L_{eq} value is typically 2-4 dB lower than the daily L_{dn} value. In less heavily developed areas, the peak-hour L_{eq} is often equal to the daily L_{dn} value. For rural areas with little nighttime traffic, the peak-hour L_{eq} value will often be 3-4 dB greater than the daily L_{dn} value.

In the context of this report, a reference to dB means "A-weighted decibel scale (dBA)". Also, dB is used to describe changes in L_{dn} values, which are A-weighted 24-hour average noise levels. When it is inappropriate to describe noise levels in terms of a 24-hour average, such as is the case with construction noise, short-term noise levels are used to evaluate impacts. Detailed background information regarding noise measurement and analyses are included in the Stage 2 EIR/EIS Technical Report (bound separately).

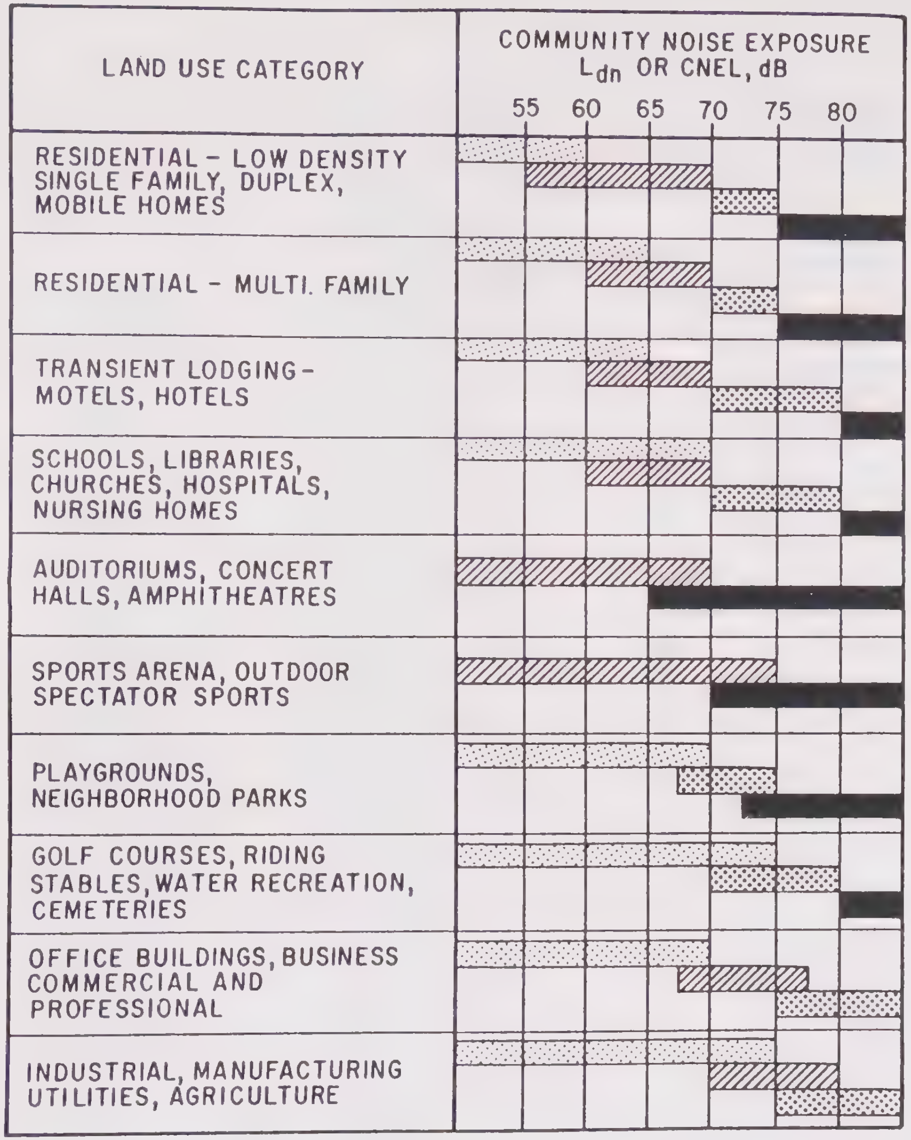
Guidelines for Interpreting Noise Levels

Local Agency Guidelines

Contra Costa County Goals and Policies. The noise element of the Contra Costa County Noise Element (Contra Costa County Community Development Department 1989a) was developed to mitigate noise conflicts where they presently exist and to minimize future noise conflicts by the adoption of policies and implementation measures designed to achieve land use compatibility for proposed development. The noise element has been developed in accordance with the requirements of Section 65302(f) of the California Government Code and follows the guidelines established by the California Department of Health Services entitled "Guidelines for the Preparation and Content of Noise Elements of the General Plan".

Relevant county noise policies are:

- New projects shall be required to meet acceptable exterior noise level standards as established in the Noise and Land Use Compatibility Guidelines. These guidelines are the same as those recommended by DHS and shown in Figure 15-1. These guidelines should be used by the county as a guide for evaluating the compatibility of "noise-sensitive" projects in potentially noisy areas.



INTERPRETATION

NORMALLY ACCEPTABLE

Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal. conventional construction, without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE

New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE

New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE

New construction or development should generally not be undertaken.

Figure 15-1. Land Use Compatibility for Community Noise Environments

Source: California Department of Health Services

- The standard of outdoor noise levels in residential areas is a L_{dn} of 60 dB. However, a L_{dn} of 60 dB or less may not be achievable in all residential areas due to economic or aesthetic constraints.

- Title 24, Part 2, of the California Code of Regulations requires that new multiple-family housing project, hotels, and motel exposed to an L_{dn} of 60 dB or greater has a detailed acoustical analysis describing how the project will provide an interior L_{dn} of 45 dB or less. The county also shall require new single-family housing project to provide for an interior L_{dn} of 45 dB or less.

  If an area is currently below the maximum "normally acceptable" noise level, an increase in noise up to the maximum should not be allowed necessarily.

  Public projects shall be designed and constructed to minimize long-term noise impacts on existing residents.

- Construction activities shall be concentrated during the hours of the day that are not noise-sensitive for adjacent land uses and should be commissioned to occur during normal work hours of the day to provide relative quiet during the more sensitive evening and early morning hours.

- Noise impacts upon the natural environment, including impacts on wildlife, shall be evaluated and considered in review of development projects.

The noise element also contains implementation measures that relate to development review. These measures require a review and analysis of noise-related impacts as part of project development review procedures. Impacts are to be evaluated in terms of applicable federal, state, and local codes, and the potential for adverse community response, based on a significant increase in existing noise levels. The use of mitigation measures associated with site planning, architectural layout of buildings, noise barriers, and construction modifications are encouraged to minimize noise impacts of proposed development.

City of Brentwood Guidelines. The City of Brentwood uses 65 dBA (L10) as the acceptable exterior noise level for residential and other noise sensitive land uses (City of Brentwood City Council 1983). (L10 is the sound level that is equaled or exceeded 10% of the time and in most cases is 1-3 dB higher than the L_{eq} sound level.)

Alameda County Guidelines. Alameda County uses 65 dBA (CNEL) as the acceptable exterior noise level for residential and other noise sensitive land uses (Alameda County Planning Commission 1975).

San Joaquin County Guidelines. The San Joaquin County land use compatibility criteria are the same as those used in Contra Costa County (San Joaquin County Planning Department 1978).

Sensitive Noise Receptors in the Project Region

The region that encompasses all the project alternatives is generally rural agricultural land with low to moderate urban development interspersed throughout the area. Several of the project alternative pipelines would be located underground in the urbanized area of Antioch and Pittsburg, north of SR 4. The majority of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives' project components are located in sparsely populated portions of eastern Contra Costa County with few nearby sensitive noise receptors.

Kellogg Creek Watershed

The Kellogg Creek watershed is rural and sparsely populated. The primary land uses consist of agriculture, rural residential uses, and some light industrial uses. The seven houses located along Vasco Road near the dam site represent the only potentially sensitive noise receptors in the watershed.

Construction Sites and Truck Routes

Los Vaqueros Reservoir and Kellogg Reservoir Alternatives

Dam Construction. The assumed truck routes that would be used to implement these project alternatives are briefly described here. Concrete will be transported to the dam site from Pleasanton north along Vasco Road. Riprap is anticipated to be trucked from a quarry off of Lake Herman Road, east of Vallejo. Trucks would cross the Carquinez Strait on I-680, travel east and then south on SR 4 to Brentwood, then travel south on Walnut Boulevard and Vasco Road to the dam site. Filter and drain materials are anticipated to be transported from Pleasanton east along I-580 then north on Vasco Road. Steel pipe would be transported from Tracy via Byron Road, Camino Diablo Road, and Vasco Road.

Land use along the Byron Highway south of Camino Diablo Road is mostly agricultural with only a few houses within 200 feet of the roadway alignment. Along Camino Diablo Road between Walnut Boulevard and the Byron Highway there are approximately 40 residences within 100 to 200 feet of the roadway. Along Walnut Boulevard between Camino Diablo and Balfour Road there 36 residences and between Balfour Road and Highway 4 there are about 30 houses of which about 20 are mobile homes.

Along Vasco Road north of the Contra Costa-Alameda county line and south of Camino Diablo Road, there are few scattered residences located between 100 and 200 feet from the roadway. Just south of the county line there are approximately eight houses with typical setbacks between 60 and 500 feet. Further south within about 1.5 miles of I-580, Vasco Road is densely populated.

The following is a general summary of sensitive land uses along SR 4 from Balfour Road to U.S. Highway 160:

SR 4 Segment	Land Use
Balfour Road to Oak Street	mix of industrial, commercial, and residential
Oak Street to Second Street	shopping center, commercial
Second Street to Central Street	all commercial
Central Street to Sand Creek Road	all commercial
Sand Creek Road to Knightsen Road	mix of industrial, commercial, and residential
Knightsen Road to Cypress Road	many residences 100-200 feet from the road
Cypress Road to Oakley Road	mix of industrial, agricultural, residential (residences 100-200 feet from the road)

Oakley Road to Big Break Road	mostly commercial with some residences 100-200 feet from the road
Big Break Road to Highway 160	mostly commercial with some agricultural, industrial, and residential uses 100-200 feet from the road.

Alternate Pipeline and Intake Configuration Sites

Land uses adjacent to the seven alternate water intake and conveyance facilities and three alternate transfer reservoirs are generally used for agriculture with scattered low-density rural residential structures. Generally, only a few sensitive land uses occur along the pipeline alignments, at intake locations, and at the transfer reservoir sites. Some of the densely populated residential lands along Creek Road near the Los Vaqueros pipeline alignment could be sensitive noise receptors.

Middle River/EBMUD Emergency Supply Alternative Intake and Pipeline Construction Sites. Land uses adjacent to the water intake and conveyance facilities, including the transfer reservoirs, are low-density rural at almost all locations. Some scattered farmhouses and farming related support facilities are in the area. Fairly dense residential development occurs along Eden Plains Road near the pipeline alignment.

Desalination/EBMUD Emergency Supply Alternative Construction Sites. Land uses adjacent to the desalination plant site and associated pipelines are all rural and have few sensitive receptors. The brine disposal pipeline alignment passes through Antioch and Pittsburg and is directly adjacent to a large number of sensitive residential receptors.

Project Area Noise Levels

The noise environment of eastern Contra Costa County varies considerably. In urbanized areas moderate to high noise levels occur that are common to densely populated areas. In rural areas background noise is generally low with common noise intrusions associated with natural sources such as wind, domestic animals and wildlife, or isolated human activity.

Major noise sources in the east county area include transportation sources, such as roads, highways, freeways, railroads, and aircraft. These sources are often referred to as "line sources" because they extend over large distances. Traffic along freeways, highways, and other major arterials is the primary source of vehicular traffic noise. The other major source of noise, "point sources", include manufacturing and commercial uses and, in some cases, recreational use. The latter uses generally are intrusive noise sources when they are near sensitive noise receptors such as residences, schools, churches, libraries, hospitals, and other similar uses.

The project area noise environment is described based on monitored data, modeled data, and noise levels typical to specific types of land uses found in the project area.

Noise Monitoring

Noise monitoring was conducted in the Kellogg Creek watershed area as part of the Vasco Road and Utility Relocation Project EIR. The results of this study are presented in the report entitled Vasco Road

Relocation Project - Environmental Noise Assessment (Illingworth & Rodkin 1989) and are summarized here for use in describing existing noise conditions. Continuous 24-hour measurements were conducted at four locations, identified as A, B, C, and D in Table 15-1. Short-term measurements of various duration were also conducted at other locations identified as 1, 2, 3, 4, 5, and 6 in Table 15-1.

Additional noise monitoring was conducted by Jones & Stokes Associates at selected locations in the project area on April 4, 1991. Measurements were taken at three locations. The first (identified as location 7 in Table 15-1) was near the desalination plant site. The second and third measurements (identified as locations 8 and 9 in Table 15-1) were taken at 50 feet from the centerline of Highway 4 about 1 mile north of Brentwood and 50 feet from the centerline of Walnut Boulevard just south of Marsh Creek. L_{dn} values at these locations were calculated based on the measured level and the hourly distribution of noise levels previously measured along Vasco Road.

Noise Modeling

Traffic noise levels along the identified construction truck routes have been predicted using traffic noise modeling. Only roadways associated with intersections that have been addressed in the traffic analysis have been analyzed in detail with modeling. Modeled roadways include:

- SR 4 north of Brentwood,
- Oak Avenue between SR 4 and Walnut Boulevard,
- Walnut Boulevard south of Brentwood and north of Concord Avenue,
- Walnut Boulevard south of Concord Avenue and north of Camino Diablo Road,
- Camino Diablo Road west and east of Walnut Boulevard, and
- Vasco Road south of the County Line Alignment.

Because the peak-hour volume of weekday traffic associated with recreation is relatively small, a simple comparison between baseline peak-hour traffic and peak-hour recreation-related traffic has been made to evaluate weekday recreation-related noise impacts. Traffic noise levels change is based on ten times the logarithm of the ratio of two traffic volumes. For example, a change in roadway traffic volume from 1,000 cars per hour to 1,260 cars per hour would result in a 1-dB noise increase.

Traffic noise impacts associated with weekend recreation trips have been analyzed in detail because most recreation trips would occur on weekends when traffic noise from other sources would be relatively minor. Therefore, associated noise levels would be low.

The County Line Alignment has been previously analyzed in the Vasco Road and Utility Relocation Project EIR. Results of this analysis are summarized in the "Environmental Consequences" section.

The Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model has been used to predict noise levels (Barry and Reagan 1978). The noise model has been modified to employ traffic noise emission levels recommended by Caltrans. For this evaluation the model has been structured to evaluate noise levels on an hourly basis over a 24-hour period, allowing direct calculation of L_{dn} values. Hourly vehicle mixes can be adjusted to allow the determination of changes in L_{dn} values that result from the addition of construction- or recreation-related traffic during specific hours. The model takes into account the V/C ratio of modeled roadways to determine the vehicle speed during each hour. A noise drop-off rate of 4.5 dB per doubling of distance from roadways has been used in the model. This assumption is consistent with the topography and terrain in the project area. Modeled and measured noise levels are compared in Table 15-2. Modeled noise levels compare favorably to measured noise levels.

Traffic Model Data. Traffic volumes used in this analysis were determined from the traffic analysis done for the traffic section of this report and the Vasco Road and Utility Relocation Project EIR. Vehicle travel speeds used in traffic modeling were based on observed speeds and posted speed limits. The

Table 15-1. Measured Noise Levels at Various Locations in the Project Area

	Location	Start Time	Duration	L_{eq}	L_{dn}
A	61 feet from centerline of Vasco Road about 1.5 miles north of I-580	1:00 p.m.	24 hours	69	73
B	70 feet from centerline of Mountain House Road south of Byron Highway	3:00 p.m.	24 hours	59	65
C	End of Camino Diablo Road, 1 mile east of Vasco Road	2:00 p.m.	24 hours	50	57
D	10,000 Morgan Territory Road	3:00 p.m.	24 hours	54	59
1	Along Northfront Road about 150 feet from nearest I-580 lane	1:20 p.m.	5 minutes	71	73
2	Northern end of Dyer Road	2:00 p.m.	2 minutes	40	40-45
3	75 feet from centerline of Byron Highway near Bruno Road	2:25 p.m.	10 minutes	71	72
4	75 feet from centerline of Camino Diablo Road near Camino Vaqueros Road	11:25 p.m.	15 minutes	58	63
5	61 feet from centerline of Vasco Road at northern end of Vasco Road	12:30 p.m.	15 minutes	68	70
6	61 feet from centerline of Vasco Road near Contra Costa-Alameda County line	1:00 p.m.	15 minutes	72	70
7	Desalination plant site				
8	50 feet from centerline of SR 4	11:00 a.m.	15 minutes	73.8	75.9
9	50 feet from centerline of Walnut Boulevard	12:45 p.m.	15 minutes	69.8	71.9

Table 15-2. Comparison of Measured and Modeled Noise Levels (L_{dn})

Location	Measured Noise Level 100 Feet from Roadway Centerline	Modeled Noise Level 100 Feet from Roadway Centerline	Difference between Measured and Modeled Noise Level
Camino Diablo Road east of Walnut Road	61.7	60.8	0.9
Vasco Road south of County Line Alignment	67.4	68.1	-0.7
SR 4 north of Brentwood	71.4	71.6	-0.2
Walnut Road north of Camino Diablo Road	67.4	65.7	1.7

Table 15-3. Traffic Mix Percentages Used in Noise Modeling Analysis

Roadway	Automobiles	Medium-Duty Trucks	Heavy-Duty Trucks
SR 4	82	4	14
Oak Avenue	94	2	4
Walnut Road	94	2	4
Camino Diablo Road	94	2	4
Vasco Road south of County Line Alignment	82	4	14

Table 15-4. Existing Noise Levels along Construction Truck Routes

Roadway	L_{dn} at 100 Feet from Roadway Centerline
Walnut Road between Camino Diablo Road and Brentwood	66
Camino Diablo Road	61
Vasco Road south of County Line Alignment[a]	68
SR 4 north of Brentwood	72

[a] At 150 feet from the nearest I-580 lane, the noise level is 73 L_{dn}.

percentage of truck trips assumed for noise modeling were estimated from onsite traffic counts, data collected by Caltrans, vehicle mix data in the Vasco Road and Utility Relocation Project EIR, and data on typical truck mixes for generic types of roads. Truck and automobile mix percentages used in this analysis are summarized in Table 15-3.

Vehicles in each category are defined as follows:

- Automobiles and Light Trucks - all vehicles with two axles and four wheels designed primarily for transportation of nine or fewer passengers or for the transportation of cargo. Generally, the vehicle weight is less than 10,000 pounds.

- Medium Trucks - all vehicles having two axles and six wheels designed for transportation of cargo. Generally, the vehicle weight is greater than 10,000 pounds but less than 26,000 pounds.

- Heavy Trucks - all vehicles having three or more axles and designed for transportation of cargo. Generally, the vehicle weight is greater than 26,000 pounds.

Kellogg Creek Watershed Noise Levels

Because of the generally low-intensity land uses, the most common noise sources in the watershed consist of remote and local traffic, occasional aircraft, farming activities, and in localized areas, light industry. Estimated background noise levels away from Vasco Road range from 40 to 45 L_{dn}, which is typical of rural settings.

Construction Site and Truck Route Noise Levels

Los Vaqueros and Kellogg Reservoir Alternatives. L_{dn} values along truck routes that would be used for construction of the project alternatives are summarized in Table 15-4. Noise levels along all truck routes are between 60 and 75 L_{dn}.

Alternate Pipeline and Intake Configuration Sites

The most common noise sources in the area encompassing the alternate pipeline and intake locations consist of remote and local traffic, occasional aircraft, farming activities, and light industry, in localized areas. Estimated background noise levels in this general area range from 40 to 50 L_{dn}.

Desalination Plant and Associated Pipeline Sites

Noise sources in the area consist of remote and local traffic, occasional aircraft, farming activities, and light industry in localized areas. Estimated background noise levels are in the range of 40 to 50 L_{dn}. Estimated noise from traffic on SR 4 and train passages on the Atchison, Topeka and Santa Fe Railroad track increase these background noise levels slightly. Estimated background noise levels along the brine disposal pipeline where development exists range from 50 to 65 L_{dn}.

Middle River Pipeline and Intake Site

Existing noise sources in the area consist of remote and local traffic, occasional aircraft, farming activities, and light industry in localized areas. Estimated background noise levels range from 40 to 50 L_{dn}.

ENVIRONMENTAL CONSEQUENCES

Impact Assessment Methodology

Noise impacts are assessed in 1995 when most project construction activity is assumed to occur and in 2025 when recreation facilities would be completed.

The number of truck trips along haul routes on a trips-per-day basis has been estimated based on the volumes of materials that would need to be transported to and from the various construction sites. The number of weekday recreation-related trips have been developed on a p.m. peak-hour basis. The number of weekend recreation-related trips have been estimated on a hourly basis over a 24-hour period.

In the recreational traffic impact analysis done for the Los Vaqueros Reservoir, the number of available parking spaces at the north and south entrances was used to estimate the number of trips generated to these locations. Each parking space was assumed to generate 1.5 round trips per day. With 1,750 parking spaces at the north entrance and 500 parking spaces at the south entrance, the project would thus generate 3,375 round trips per day. No trips were projected to travel to the southend site from areas north of the reservoir. Ninety-three percent of the trips are projected to come from I-580, 5% from SR 4, and about 2% from both eastbound and westbound Camino Diablo Road. A detailed discussion of construction- and recreation-related trips is presented in the Stage 2 EIR/EIS Technical Report (bound separately), and in Chapter 13, "Transportation".

Truck trips are assumed to be spread evenly throughout a 10-hour workday from 7:00 a.m. to 5:00 p.m during weekdays. All construction worker commute trips are assumed to occur during morning and afternoon commute hours. Weekday recreation-related trips are assumed to occur during a single p.m. peak hour, and weekend recreation trips have been distributed over a 24-hour period based on counts taken at San Pablo Reservoir as identified in Chapter 13, "Transportation".

Criteria for Conclusions of Significance

Noise impact significance is based on the land use compatibility criteria presented in the noise element of the Contra Costa County general plan and on the incremental increase in noise caused by the alternatives relative to the No-Action Alternative conditions. An increase in noise of 3 dB or less is typically not perceptible.

A noise impact will be considered significant if:

- the predicted noise levels from the project exceed 60 L_{dn} near sensitive land uses, the incremental increase in noise attributed to the project relative to No-Action Alternative conditions is greater than 3 dB, and increased noise levels would occur over time and
- the incremental increase in noise attributed to the project alternative relative to No-Action Alternative conditions is greater than 5 dB, Contra Costa County's predicted noise level is within 10 dB of the compatibility criterion described in the "Affected Environment" section, and increased noise levels would occur over time.

Construction noise impacts in 1995 have been assessed by adding the construction-related truck and worker trips to projected 1995 traffic volumes and by assessing the likely effects of construction site noise levels on nearby sensitive noise receptors. Recreation noise impacts in 2025 have been assessed by

adding recreation-related trips to projected 2025 traffic volumes and by qualitatively evaluating increased recreation noise effects on land uses in or near the Kellogg Creek watershed.

No-Action Alternative

Under the No-Action Alternative, 1995 noise levels in the Kellogg Creek watershed would remain in the range of 40-50 L_{dn}. Noise levels along the routes that would be used for constructing the reservoir alternatives would increase by less than 2 dB as a result of project traffic growth in the area. These impacts would be less than significant because noise levels of 40-50 L_{dn} are within the acceptable range for sensitive land uses and an increase of less than 2 dB along roadways would not be perceived. No mitigation is required.

Background noise levels near the seven alternate pipeline/intake configuration sites would remain in the range of 40-50 L_{dn}, as would background noise levels near the Middle River pipeline/intake configuration sites and the desalination plant site. Background noise levels along developed areas near the brine disposal pipeline alignment would increase slightly (less than 2 dB) as a result of increased regional development. These impacts would be less than significance for the same reasons discussed above for the Kellogg Creek watershed. No mitigation is required.

Under the No-Action Alternative, 2025 noise levels in the Kellogg Creek watershed would remain in the range of 40-50 L_{dn} and noise levels on roadways near the watershed would increase by about 4 dB above existing conditions noise levels. Increases in noise along roadways would occur as a result of an estimated 157% increase in traffic volumes on these roadways. These impacts would be less than significant. No mitigation is required.

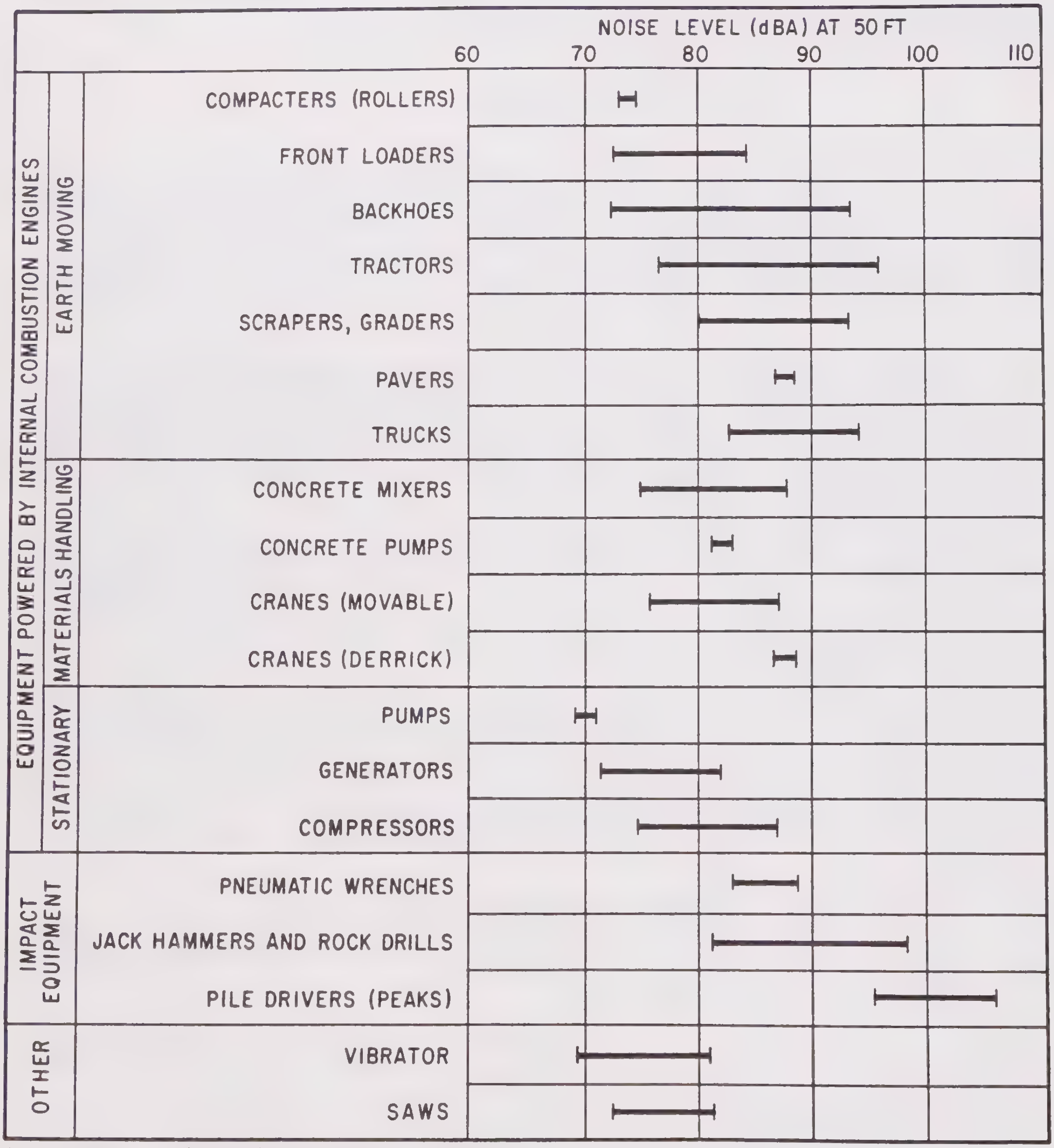
Noise impacts related to future expansions of the Contra Costa Canal would be localized and temporary but could affect a substantial number of nearby residences. Construction noise levels would likely be 80-90 dB at the Contra Costa Canal construction sites, which is a typical noise level for construction vehicles and equipment (Figure 15-2). The potential for substantial, temporary construction noise impacts on sensitive receptors along the Contra Costa Canal would be a significant impact. To reduce these impacts to less-than-significant levels, construction noise reduction measures should be implemented, as appropriate.

Los Vaqueros Reservoir Alternative

Noise Impacts of Dam and Reservoir Construction

Noise-producing construction activities that would occur at the dam site and within the watershed area include:

- foundation preparation,
- grouting of the embankment foundation area,
- dewatering of embankment foundation area,
- Kellogg Creek diversion,
- placement of embankment materials,
- inlet/outlet tunnel construction,
- reservoir clearing, and
- spoil material disposal.



Note: Based on Limited Available Data Samples

Figure 15 -2. Construction Equipment Noise Ranges

Source: U.S. Environmental Protection Agency 1971

These construction activities would involve the use of scrapers, bulldozers, front-end loaders, grout pumps, dewatering pumps, graders, compactors, cranes, and blasting and hauling vehicles. The types of construction equipment used for this project would typically generate noise levels of 80-90 dBA at a distance of 50 feet while the equipment is operating (U.S. Environmental Protection Agency 1971, Toth 1979, Gharabegian et al. 1985). Construction equipment operations can vary from intermittent to fairly continuous, with multiple pieces of equipment operating concurrently. Assuming that a bulldozer (87 dBA), backhoe (90 dBA), grader (90 dBA), and front-end loader (82 dBA) are operating concurrently in the same area, peak construction-period noise would generally be about 94 dBA at 50 feet from the construction site.

Typical distance attenuation for construction noise in the project area is shown in Table 15-5. The atmospheric absorption parameter assumed in Table 15-5 reflects minimal absorption for typical construction equipment noise spectra (e.g., bulldozer, water truck). The atmospheric absorption parameter was calculated using procedures described in Acoustical Society of America (1978).

Locations within about 1,900 feet of a construction site would experience occasional episodes of noise levels greater than 60 dBA. Areas within about 740 feet of a construction site would experience episodes with noise levels greater than 70 dBA. Such episodes of high noise levels would not be continuous throughout the day, and generally would be restricted to daytime hours.

Blast and drill methods would be used to excavate the dam outlet/inlet shaft. Blasting would occur on the surface for a short period and then would occur below the ground.

Dam and reservoir construction activities would result in increased noise levels within the watershed. There are no residences within 2,000 feet, however. The only residences near enough to be subject to increased noise levels belong to leaseholders on CCWD-owned lands who would have entered into those leases with full knowledge of CCWD's proposed construction activities. Therefore, this impact would be less than significant. No mitigation is required.

Noise Impacts Associated with Construction Truck Traffic

Combined truck and background traffic noise levels along construction truck routes in 1995 are summarized in Table 15-6. Construction-related traffic would result in an increase in L_{dn} values of less than 1 dB. For this reason, noise impacts associated with construction traffic would be less than significant. No mitigation is required.

Noise Impacts of Los Vaqueros Pipeline Construction

Construction of the Los Vaqueros pipeline would involve excavation of soils along the alignment, delivery of pipe and other materials, placement of pipe, and restoration of the alignment. CCWD estimates that construction of pipelines would generally proceed at a rate of 200-300 feet per day, less at major road crossings. Noise levels at construction areas will be similar to those discussed under construction within the Kellogg Creek watershed (80-90 L_{dn}). With construction moving at 200-300 feet per day, noise impacts in any one area would be short in duration. Because the few sensitive noise receptors located along this alignment would be affected for relatively short periods, these potential construction noise impacts would be less than significant. No mitigation is required. Should special circumstances result in localized construction noise impacts that would occur for more than 1 week, they could easily be reduced by employing noise-reducing construction practices.

Truck trips needed to deliver construction materials would be routed along several different access routes. These trips would all occur during daytime hours and would be spread over a fairly large geographic area. Accordingly, they will not substantially increase L_{dn} noise values along individual travel routes. Noise impacts from construction-related truck and automobile trips would thus be less than significant. No mitigation is required.

Table 15-5. Distance Attenuation for Construction Noise in the Project Area

Distance Attenuation		Distance to dB Contours	
Receptor Distance (feet)	Noise Level at Receptor (dBA)	Noise Contour Value (dBA)	Contour Distance (feet)
50	94.0	105	14
100	87.9	100	25
200	81.8	95	45
400	75.5	90	79
600	71.7	85	138
800	68.9	80	240
1,000	66.6	75	417
1,500	62.3	70	736
2,000	59.1	65	1,115
2,500	56.4	60	1,918
3,000	54.1	55	2,902
4,000	50.0	50	4,006
5,280	45.7	45	5,365
7,500	39.3	40	7,407
9,000	35.4	35	9,054
10,560	31.6	30	10,785
15,840	20.1	25	15,170

Notes: The following assumptions were used:

Basic sound-level dropoff rate = 6.0 dB/doubling.
Atmospheric absorption coefficient = 0.5 dB/100 meters.
Reference noise level = 94 dBA.
Distance for reference noise level = 50 feet.

Drop-off calculations include atmospheric absorption at 0.5 dB/100 meters, centered at reference distance.

Except for sound with highly distinctive tonal characteristics, noise from a particular source will not be identifiable when its incremental noise level contribution is significantly less than background noise levels.

Contour distance calculations are most accurate within the decibel range of the direct attenuation calculations.

Table 15-6. Day-Night Noise Levels (L_{dn}) along Construction Truck Routes

Receptor Number and Location	Land Use Compatibility Criterion	Existing Conditions (1992)	No-Action Alternative - Existing Conditions (1995)	Los Vaqueros Reservoir Alternative	Kellogg Reservoir Alternative	Los Vaqueros Reservoir Alternative versus No-Action Alternative - Existing Conditions	Kellogg Reservoir Alternative versus No-Action Alternative - Existing Conditions (1995)
1 SR 4 north of Brentwood	60	71.6	72.2	72.3	72.3	0.1	0.1
2 Oak Avenue between SR 4 and Walnut Boulevard	60	59.4	60.2	60.8	60.6	0.6	0.4
3 Walnut Boulevard south of Brentwood and north of Concord Avenue	60	63.1	64.4	64.5	64.6	0.1	0.2
4 Walnut Boulevard south of Concord Avenue and north of Camino Diablo Road	60	65.7	66.8	67.0	67.1	0.2	0.3
5 Camino Diablo Road east of Walnut Road	60	60.8	62.3	62.6	62.6	0.3	0.3
6 Vasco Road south of County Line Alignment	60	68.1	69.1	69.2	69.3	0.1	0.2

Note: All locations are 100 feet from the centerline of the roadway.

Noise Impacts of Alternate Pipeline and Intake Configuration Construction and Operation

Noise impacts of construction and operation of the alternate project configurations would generally be similar because construction and operation procedures would be similar for each configuration and because all the configurations would be located in sparsely populated areas with few sensitive receptors. In isolated cases, pipeline construction may have minor, short-term effects on rural residences. Because noise effects of these alternate configurations would all be similar, impacts are discussed generally for all configurations.

The facilities that would be required under each configuration to transfer water from the Delta to the Los Vaqueros Reservoir include:

- a water conveyance pipeline,
- an intake facility, and
- a transfer reservoir.

Construction of the conveyance pipelines would involve excavation of soils, delivery of pipe and other construction materials, placement of pipe, and restoration of the placement area. Noise levels at construction areas would be similar to those discussed for construction of the dam and reservoir (80-90 L_{dn}). With construction moving at 200-300 feet per day, noise impacts on any one area would be short in duration. Because any possible adverse noise effects would be temporary and isolated for all alternate configurations, these impacts would be less than significant. No mitigation is required. Should isolated construction noise impacts occur, they could easily be reduced to acceptable levels by employing noise-reducing construction practices.

Construction of intake facilities would include excavation, facilities placement (including pile driving), levee modification, and spoil disposal. Construction of transfer reservoir facilities would include excavation and facility placement. Noise levels near these facilities during the construction period would likely range from 80-90 L_{dn}. Because few sensitive receptors would be located near these construction sites, these construction noise impacts would be less than significant. No mitigation is required.

The estimated number of heavy truck trips for intake construction would be routed along several different access routes depending on the materials being transported. These truck trips would also occur during daytime hours and would be spread over a fairly large geographic area. Thus, L_{dn} noise values along travel routes would not be substantially increased. Noise impacts from construction-related truck and auto trips would be less than significant. No mitigation is required.

The pumping plants at the alternate intake facility and transfer reservoir sites are assumed to be enclosed in concrete structures. Given the lack of current development near the alternate intake and transfer reservoir sites and the enclosed nature of these facilities, the noise impacts from operation of these pumps would be less than significant. No mitigation is required.

Noise Impacts of Recreation in 2025

Recreation in the Kellogg Creek watershed would generate approximately 460 peak-hour recreation-related trips on weekdays. This traffic volume distributed among the roadways surrounding the watershed would result in a peak-hour weekday noise level increase of less than 1 dB on any of the access roads. Therefore, these impacts would be less than significant. No mitigation is required.

Estimates of weekend L_{dn} values along recreation access routes with and without recreation-related traffic noise are summarized in Table 15-7. In some cases, the average daily noise levels decline when recreation traffic is combined with projected background traffic volumes; this inverse traffic-to-noise level relationship occurs when the V/C ratio on a roadway during certain hours results in reduced travel speeds

Table 15-7. Weekend Recreation Day-Night Noise Levels (L_{dn}) along Recreation Access Routes

Receptor Location	Land Use Compatibility Criterion	Existing Conditions (1992)	No-Action Alternative Future Conditions (2025)	Los Vaqueros Reservoir and Kellogg Reservoir Alternatives	Difference between No-Action Alternative - Future Conditions and Reservoir Alternatives
Walnut Boulevard north of Camino Diablo Road detour	60	63.1	68.3	68.1	-0.2
Walnut Boulevard south of Camino Diablo Road detour	60	65.7	69.4	60.2	0.8
Camino Diablo Road east of Camino Diablo Road detour	60	60.8	64.6	64.6	0.0
Camino Diablo Road between Walnut Road and Camino Diablo Road detour	60	60.8	62.7	64.1	1.4
Camino Diablo Road west of Walnut Road	60	59.5	64.6	64.6	0.0
Vasco Road south of County Line Alignment	60	68.1	69.9	69.7	-0.2

Note: All locations are 100 feet from the centerline of the roadway.

because of poorer operating conditions. The noise model used to determine weekend average daily noise levels accounts for average hourly travel speeds. A roadway that operates under congested conditions during certain hours would result in reduced travel speeds during this period and a drop in noise levels. The analysis indicates that the addition of recreation trips would not increase noise levels by more than 2 dB on any of the recreation access routes. Therefore, this impact would be less than significant. No mitigation is required.

The recreation facilities are envisioned to accommodate a design capacity of 5,300-9,500 daily users on a peak holiday weekend in 2025. This possible level of use would increase the noise levels in the watershed compared to noise levels under the No-Action Alternative. It would be extremely difficult to accurately model the future recreation noise levels at different locations in the watershed because of these highly varied topography and uncertain recreation use patterns. However, the likely noise effects on sensitive human noise receptors is expected to be minor or imperceptible because at the time of recreation buildout in 2025, no sensitive receptors would be located within approximately 2 miles of major recreation use areas planned for the watershed. Residences on Morgan Territory Road would not perceive increases in noise levels in the watershed because of their distance from use areas and natural noise attenuation resulting from the location of a major ridgeline between residents and recreation areas. Reservoir boating uses would be limited to low-horsepower boats that would not affect sensitive human receptors. Therefore, noise impacts from point sources in the Kellogg Creek watershed would be less than significant. No mitigation is required.

Noise Impacts of the Vasco Road and Utility Relocation Project

Implementation of the County Line Alignment (Modified) and the proposed utility relocations would result in less-than-significant noise impacts as indicated in the Vasco Road and Utility Relocation Project EIR. No additional mitigation is required.

Kellogg Reservoir Alternative

Impacts of Dam and Reservoir Construction and Operation

Equipment and procedures used to construct the Kellogg Reservoir Alternative dam and reservoir would be similar to that of the Los Vaqueros Reservoir Alternative except construction of the Kellogg Reservoir would take approximately 11 months longer. Thus, construction noise levels under this alternative would be similar to the Los Vaqueros Reservoir Alternative. Although there are only a few residences near where construction would occur, construction activities have the potential to adversely affect these residences over a 2-year construction period. This impact would be significant. To reduce this impact to a less-than-significant level, noise-reducing construction practices should be implemented at the dam site.

Noise Impacts Associated with Construction Truck Traffic

All the materials for the Kellogg Reservoir Alternative dam and reservoir facilities would be transported along the same truck routes as those identified under the Los Vaqueros Reservoir Alternative. Noise levels along truck routes with and without this alternative are summarized in Table 15-7. Construction-related traffic results in an increase of L_{dn} values of less than 1 dB on any of the truck routes. Therefore, noise impacts from construction-related traffic would be less than significant. No mitigation is required.

Noise Impacts of Los Vaqueros Pipeline Construction

Noise impacts associated with construction of the Los Vaqueros pipeline under the Kellogg Reservoir Alternative are the same as those described under the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

Noise Impacts of Old River No. 5 Pipeline and Intake Configuration Construction and Operation

Noise impacts under this alternative associated with construction and operation of the Old River No. 5 pipeline, intake, and Camino Diablo transfer reservoir would be the same as the impacts described under the Los Vaqueros Reservoir Alternative. These impacts would be less than significant. No mitigation is required.

Impacts of Recreation in 2025

Evaluation of noise impacts associated with recreation use of the watershed under the Kellogg Reservoir Alternative assume that the general level of use and type of uses would be the same as under the Los Vaqueros Reservoir Alternative. The effect of recreation users on weekday and weekend traffic noise and peak daily watershed recreation noise levels would be less than significant for the same reasons discussed for the Los Vaqueros Reservoir Alternative. No mitigation is required.

Desalination/EBMUD Emergency Supply Alternative

Noise Impacts of Desalination Plant and Conveyance Facilities Construction and Operation

The facilities or activities that would be required under this alternative include:

- widening of Rock Slough,
- the desalination plant facility,
- an intertie to Mokelumne Aqueduct,
- a pumping plant, and
- a brine disposal pipeline.

Construction of the conveyance pipelines would involve excavation of soils, delivery of pipe and other materials, placement of pipe, and restoration of the placement area. As with other pipeline alternatives, pipeline construction would generally proceed at a rate of 200-300 feet per day, less at major road crossings. Noise levels at the placement area would be between 80-90 L_{dn} (similar to those discussed under construction within the watershed). This impact would be less than significant because noise effects would be temporary. With construction moving at 200-300 feet per day, noise impacts on any one area will be short in duration. For this reason, the construction noise impact would be less than significant. Should any construction noise impacts occur, they can be reduced to a less-than-significant level by employing noise-reducing construction practices.

Construction of desalination plant and pumping facilities would include excavation, facilities placement, and spoil disposal. Construction noise levels near these facilities would be between 80-90 L_{dn}. Because of the lack of current development near these facilities, construction noise impacts would be less than significant. No mitigation is required.

Heavy truck trips needed to deliver construction materials and equipment associated with the facility construction and the pipeline installation would occur over a 24-month period along several different access

routes depending on the active installation point. These trips will all be occurring during daytime hours and will be spread over a fairly large geographic area. Accordingly, they will not substantially increase L_{dn} noise values along travel routes. Noise impacts from construction-related truck and worker trips would thus be less than significant. No mitigation is required.

The pumping plant facilities are assumed to be enclosed in concrete structures. Given the lack of current development near the proposed facility and the enclosed nature of this facility, the noise impact from operation of these facilities would be less than significant. No mitigation is required.

Operation of the desalination facility has the potential to generate high noise levels. Potentially noisy operations may include feedwater pumping, power generation, and the reverse osmosis process. Because no sensitive receptors are located near the plant site and because most facilities would be enclosed, this impact would be less than significant. Should planned development conflict with this alternative, these developments should be designed to buffer the noise effect of plant operations.

Middle River Intake/EBMUD Emergency Supply Alternative

Noise Impacts of Pipeline and Intake Construction and Operation

The facilities that would be required under this alternative include:

- an intake on Middle River,
- a conveyance pipeline from Middle River to the Contra Costa Canal,
- blending facilities to mix diverted water with water in the Contra Costa Canal, and
- an EBMUD intertie pipeline.

Construction of the conveyance pipelines would involve excavation of soils, delivery of pipe and other materials, placement of pipe, and restoration of the placement area. CCWD estimates that construction of pipelines would generally proceed at a rate of 200-300 feet per day, but less at major road crossings. Noise levels at the placement area would likely be between 80-90 L_{dn} because of the construction equipment needed to implement this alternative. With construction occurring at 200-300 feet per day, noise impacts on any one area would be short in duration. Because these impacts are temporary and the pipeline alignment would be located in open space and agricultural areas, construction noise impacts would be less than significant. Should any construction noise impacts occur, they can be reduced to a less-than-significant level by implementing noise-reducing construction practices.

Construction of intake facilities would include excavation; facilities placement, including pile driving; levee modification; and spoil disposal. Construction of transfer reservoir facilities would include excavation and facility placement. Noise levels near the facilities would be similar to those discussed for pipeline placement (80-90 L_{dn}). Because no sensitive receptors are located near the intake facility and transfer reservoir, construction noise impacts would be less than significant. No mitigation is required.

Construction-related trips needed to deliver construction materials and equipment would occur over a 24-month period along several different access routes. These trips would occur during daytime hours and would be spread over a fairly large geographic area. Accordingly, construction-related trips associated with this alternative would not substantially increase L_{dn} noise values along travel routes. Therefore, noise impacts from construction-related truck and worker trips would be less than significant. No mitigation is required.

The pumping plants would be enclosed in concrete structures. Because there would be no sensitive noise receptors near the intake facility and because pumping equipment would be enclosed, the noise impacts from operation of these facilities would be less than significant. No mitigation is required.

MITIGATION MEASURES

Kellogg Reservoir Alternative

Noise Impacts of Dam and Reservoir Construction and Operation

15-1: Implement Noise-Reducing Construction Practices. CCWD should require implementation of the following noise-reducing measures during the dam and reservoir construction period. Implementation of these measures would reduce the effect of construction noise on nearby residences to a less-than-significant level:

- Restrict construction activities within 1,000 feet of residences to daytime hours. No construction shall be performed within 1,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 7:00 p.m. and 7:00 a.m. on other days. Any variance from this condition must be approved by Contra Costa County.

- All equipment shall have sound-control devices no less effective than those provided on the original equipment. No equipment shall have an unmuffled exhaust.

- All equipment shall comply with pertinent EPA equipment noise standards.

- No pile-driving or blasting operations shall be performed within 3,000 feet of an occupied dwelling unit on Sundays, legal holidays, or between the hours of 8:00 p.m. and 8:00 a.m. on other days. Any variance from this condition must be approved by Contra Costa County.

- The noise from any rock-crushing or screening operations performed within 3,000 feet of any occupied dwelling unit shall be mitigated by strategic placement of material stockpiles between the operation and the affected dwelling or by other means approved by the program manager.

- As directed by Contra Costa County, contractors shall implement appropriate additional noise mitigation measures including, but not limited to, changing the location of stationary construction equipment, shutting of idling equipment, rescheduling construction activity, notifying adjacent residents in advance of construction work, or installing acoustic barriers around stationary construction noise sources.

No additional mitigation measures would be required.

Desalination/EBMUD Emergency Supply Alternative

No mitigation is required. If future development of parcels adjacent to the plant site occurs, the following measures could reduce potential noise effects of plant operations on adjacent land uses to a less-than-significant level:

- construct noise-reducing barriers and enclosures around noise-generating equipment,
- place in-line mufflers and sound traps on plant exhaust systems,
- use vibration isolation mountings to isolate radiating surfaces from vibration sources, and
- select the least sensitive times of day for operation of noise generating equipment.

All Other Alternatives

No mitigation is required.

Chapter 16. Public Services

AFFECTED ENVIRONMENT

Introduction

This chapter describes the existing resources for sewer, water, drainage, solid waste, law enforcement, fire protection, ambulance, hospitals, and road maintenance, and general plan policies relevant to implementation of the alternatives. Schools are not discussed because they would not be directly affected by the alternatives considered in this EIR/EIS. This chapter also evaluates effects of the project alternatives on costs and revenues associated with public services in the project area. This evaluation focuses on Contra Costa County's general fund and a special district potentially affected by the project alternatives. These fiscal analyses assume that CCWD owns, has annexed, and manages or funds the management of Kellogg Creek watershed lands.

Contra Costa County's final adopted budget for the fiscal year ending June 30, 1991, totals approximately $597.4 million. The general fund, totaling approximately $554.4 million, represents 93% of the total county budget and is used to pay for most basic countywide services. The remaining county budget is allocated to special funds that are targeted to specific activities. (Contra Costa County Administrator's Office 1990.)

The county is currently experiencing major budget shortfalls and county staff layoffs because of recent reductions in state and federal revenue transfers to the county. Budget difficulties have been further exacerbated by the nationwide recession. Last year the county cut $13.7 million in expenditures to match revenues and is expected to cut budget expenditures further next year. (Ania pers. comm.)

County revenues are grouped into 10 general categories: current property taxes; taxes other than current property taxes; license, permit, and franchise fees; fines, forfeits, and penalties; use of money and property; intergovernmental revenues; charges for services; miscellaneous revenues; fund balances from the previous year; and cancellation of prior year designations.

The largest revenue source to the county is intergovernmental revenues, supplying 49% of county funds. Intergovernmental revenues consist primarily of state and federal aid for family income maintenance, including Aid to Families with Dependent Children.

Current property tax revenues are the second largest source of funds and account for 24% of total county revenues.

County expenditures are also grouped into 10 general categories: general county (administration) expenditures; public protection; health and sanitation; public assistance; education; public ways and facilities; recreation and cultural services; debt service; appropriations for contingencies; and provisions for reserves and designations.

The largest expenditure category is public assistance, to which 36% of the county budget is allocated. Public protection expenditures rank second, using 26% of total county funds.

Implementing the alternatives would primarily affect services provided by the county and special districts formed to provide services in unincorporated portions of the county. The alternatives could

potentially affect several special districts through the loss of property tax revenues; however, an evaluation of effects indicated that only three districts could be materially affected by implementing the alternatives. Only the fiscal setting of and project-related impacts on these three districts are discussed below.

Kellogg Creek Watershed and Vicinity

Sewer Service

Wastewater generated in the Kellogg Creek watershed is processed by private septic systems. The area is not within the boundaries of a sanitation district and does not receive direct service from a sewer agency (Contra Costa County Community Development Department 1991).

Relevant General Plan Policies. The following Contra Costa County general plan sewer service policies are relevant:

7-33 At the project approval stage, the County shall require new development to demonstrate that wastewater treatment capacity can be provided. The County shall determine whether (1) capacity exists within the wastewater treatment system if a development project is built within a set period of time, or (2) capacity will be provided by a funded program or other mechanism. This finding will be based on information furnished or made available to the County from consultations with the appropriate water agency, the applicant, or other sources.

7-35 Opportunities for using reclaimed wastewater shall be identified and developed in cooperation with sewer service and water service agencies.

7-36 Beneficial uses of treated wastewater including marsh enhancement and agricultural irrigation shall be encouraged. Such wastewater reclamation concepts shall be incorporated into resource management programs and land use planning.

Relevant Implementation Measures. The following Contra Costa County general plan sewer service implementation measures are relevant:

7-t Conditionally approve all tentative subdivision maps and other preliminary development plans on verification of adequate wastewater treatment capacity for the project. Such condition shall be satisfied by verification based upon substantial information in the record that capacity within the system to serve the specific development project exists or comparable demonstration of adequate wastewater treatment capacity. Where no tentative map or preliminary plan is required prior to development, approve no map or development permit without this standard being satisfied.

7-w Continue to enforce Sections 420-6.002 and 4200-6.008 of the County Code, which regulate the placement of septic tanks within the watersheds of reservoirs.

Water Service

Water used in the Kellogg Creek watershed is obtained from groundwater through wells and springs. Although owned by CCWD, the area does not currently receive service from a water agency (Contra Costa County Community Development Department 1991).

Relevant General Plan Policies. The following Contra Costa County general plan water service policies are relevant:

7-16 Water service systems shall be required to meet regulatory standards for water delivery, water storage, and emergency water supplies.

7-20 Development of rural residences or other uses that will be served by well water or an underground water supply will be discouraged if a high nitrate concentration is found following Health Services Department testing.

7-21 At the project approval stage, the County shall require new development to demonstrate that adequate water quantity and quality can be provided. The County shall determine whether (1) capacity exists within the water system if a development project is built within a set period of time, or (2) capacity will be provided by a funded program or other mechanism. This finding will be based on information furnished or made available to the County from consultations with the appropriate water agency, the applicant, or other sources.

7-24 Opportunities shall be identified and developed in cooperation with water service agencies for use of non-potable water, including ground water, reclaimed water, and untreated surface water, for other than domestic use.

7-26 The need for water system improvements shall be reduced by encouraging new development to incorporate water conservation measures to decrease peak water use.

7-27 The reclamation of water shall be encouraged as a supplement to existing water supplies.

Drainage Improvements

Drainage improvements in the Kellogg Creek watershed have been constructed by private landowners. The county defines the area as "nonurban" and does not provide county drainage assistance (Contra Costa County Community Development Department 1991).

Relevant General Plan Policies. No general plan policies that address drainage are relevant to implementation of the alternatives.

Solid Waste Disposal Service

Collection. Solid waste collection in the Kellogg Creek watershed and vicinity is the responsibility of several hauling companies and individual residents. Population centers such as Brentwood, Oakley, and Discovery Bay receive service from private solid waste hauling companies. These companies have no specified service areas and are free to extend service to areas when economically feasible. Residents in areas not served by solid waste haulers are responsible for transporting their refuse to the landfill. (Hoffman pers. comm.)

Landfills. There are three sanitary landfills in east Contra Costa and Alameda Counties: the Vasco Road Landfill and the Altamont Pass Sanitary Landfill, both located in Alameda County, and the Contra Costa Sanitary Landfill in Contra Costa County (Figure 16-1). Waste generated in the Kellogg Creek watershed and vicinity would normally be sent to the Contra Costa Sanitary Landfill because it is the nearest Contra Costa County landfill.

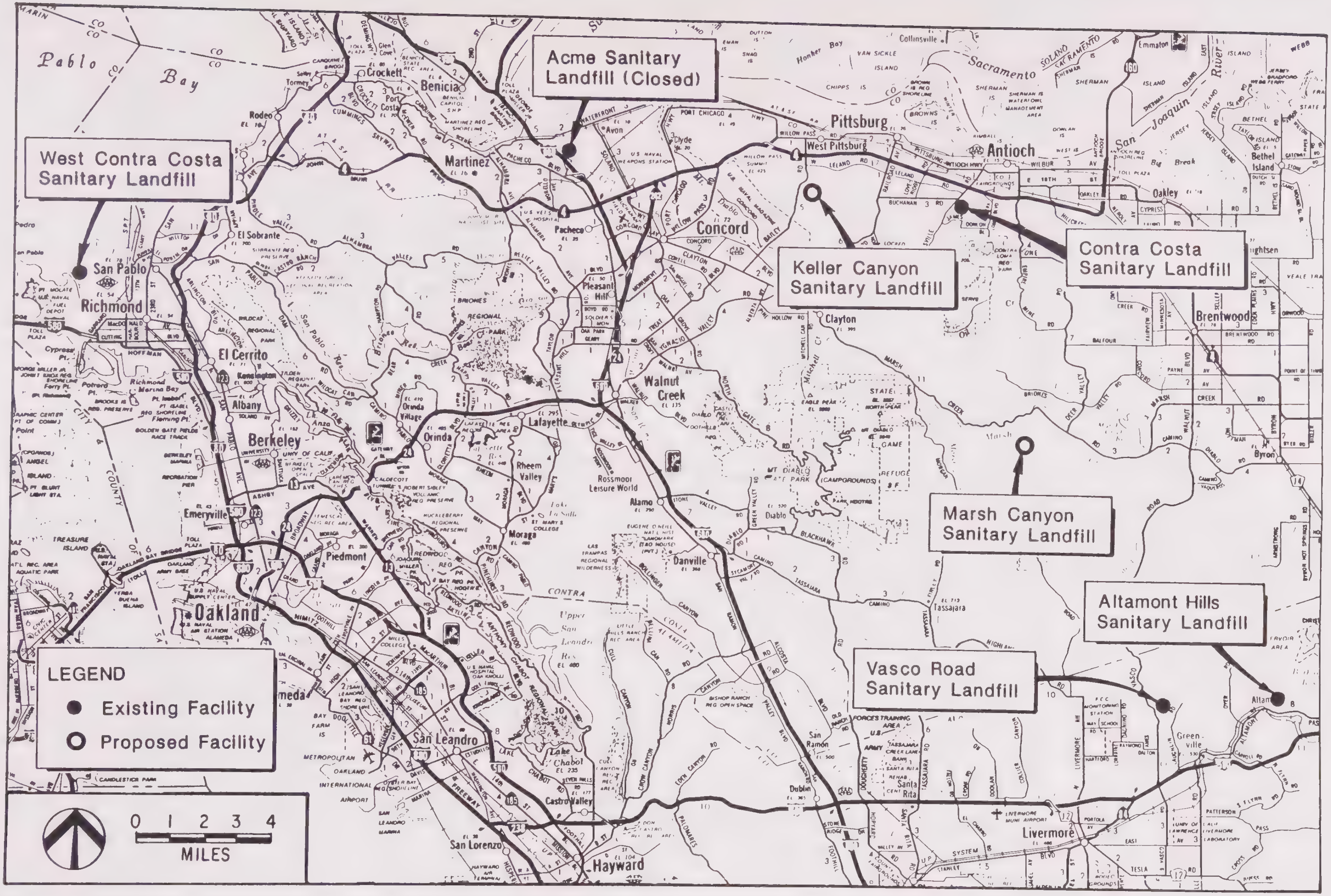


Figure 16-1. Existing and Proposed Landfills in Contra Costa and Northern Alameda Counties

Contra Costa County, however, has used most of its landfill capacity and is attempting to open two new landfills to ensure the availability of long-term landfill capacity (Figure 16-1). Lawsuits and the permitting process could delay the opening of one or both of these landfills to about mid-1993.

In the interim, Contra Costa County contracted to transport a maximum of 275 trucks per week, or 60 per day, to the Altamont Sanitary Landfill. The county exceeded that amount and now operates under a revised contract allowing it to deposit 580,000 tons at Altamont during 1991, which is approximately 1,590 tons per day.

Alameda County will experience a landfill capacity shortage in the near future, as will most other Bay Area counties, so Contra Costa County is seeking to develop contracts for landfill space with San Joaquin County and/or Stanislaus County (Nicholson pers. comm.).

Relevant General Plan Policies. The following Contra Costa County general plan solid waste management policy is relevant:

7-92 Solid waste resource recovery (including recycling, composting, and waste to energy) shall be encouraged so as to extend the life of sanitary landfills, reduce the environmental impact of solid waste disposal, and to make use of a valuable resource. provided that specific resource recovery programs are economically and environmentally desirable.

Law Enforcement Service

Two agencies primarily responsible for law enforcement in the Kellogg Creek watershed and vicinity are the Contra Costa County Sheriff's Department, and the California Highway Patrol (CHP); a small portion of the Kellogg Creek watershed extends into Alameda County and is serviced by that county. However, because no facilities other than a short segment of Vasco Road would be located within Alameda County under the Los Vaqueros or Kellogg Reservoir Alternatives, this agency would not be substantially affected.

Contra Costa County Sheriff's Department. All non-traffic-related calls in unincorporated areas of Contra Costa County are the responsibility of the sheriff's department. The sheriff's department employs 146 patrol personnel at four stations countywide and is equipped with 56 patrol units. Minimally, 15 of these units are active at any given time. The station closest to the project site is the Delta Station, located in Oakley. The station is staffed with 32 patrol-related personnel and has a minimum of four units in the field at any given time. Response time to the Kellogg Creek watershed area from Delta Station is approximately 8-10 minutes, although it is likely that a unit would be available to respond to a call more quickly (Sherock pers. comm.).

California Highway Patrol. The CHP responds to all traffic-related calls in the project area. The nearest station is located in Dublin and is equipped with 25 road patrol units. An average of 10 units are active at any one time, depending on the time of day. The Kellogg Creek watershed and vicinity is within Beat 053, which is patrolled by one unit. (Velmen pers. comm.). Although calls to the area are infrequent, several officers stated that most of the calls from the project area involve accidents on Vasco Road because of the road's inadequacy to serve as a major arterial (Jones & Stokes Associates 1989).

Relevant General Plan Policies. No general plan policies that address law enforcement are relevant.

Fire Protection Service

Four agencies are primarily responsible for fire protection service in the Kellogg Creek watershed and vicinity: the Byron Fire Protection District (BFPD), the East Diablo Fire Protection District (EDFPD), the San Ramon Fire Protection District (SRFPD), and the California Department of Forestry and Fire Protection (CDF). The fire districts are mainly responsible for medical aid and structure fire incidents. Even though fire district engines are usually first on the scene, CDF is responsible for all wildland fires and assumes control of all such incidents when arriving at the fire.

Several events will occur in the near future that will increase the effectiveness of fire protection in the county. BFPD will be merging with EDFPD, and the Contra Costa County Consolidated Fire District will be given the responsibility for dispatching all fire suppression units in the county.

Byron Fire Protection District. BFPD provides service to the northeastern and eastern portions of the project area from two fire stations. Station 97 in Byron is equipped with two engines, one rescue unit, one four-wheel-drive power wagon, and two water tenders. The station is operated by 18 paid on-call and two full-time firefighters. Response time to the furthest point in the project area (within Contra Costa County) is approximately 10-15 minutes. Wildfire response time to remote areas inaccessible by paved road is approximately 25 minutes. Station 98, located in Discovery Bay, is equipped with two water tenders and staffed with 20 paid on-call firefighters. Response time from this station is 6-7 minutes longer than from Station 97. The frequency of calls to the project area is very low, ranging from five to 15 calls per year (Jones & Stokes Associates 1990, Hein pers. comm.)

BFPD maintains an Insurance Services Office rating of 8 except for within Discovery Bay, where it achieves a 7 (Hein pers. comm.). The Insurance Services Office rating indicates firefighting capability on a scale of 1-10 with 1 being the best.

BFPD plans to build another station at the Bixler Road/Point of Timber intersection to serve the proposed expansion of Discovery Bay. The district has collected developer fees for the past 3 years to finance this expansion. (Hein pers. comm.)

BFPD receives funding from the county's general funds with an apportionment factor of 0.00071 applied to both secured and unsecured property tax revenues. Budget requirements not covered by the property tax apportionment are supplied by monies from the Special District Augmentation fund, also a division of the general fund (Komero pers. comm.).

East Diablo Fire Protection District. EDFPD provides service to most of the area near Vasco Road and to the areas west of Vasco Road from four stations, two in Brentwood, one at the Marsh Creek Road/Deer Valley intersection, and one at the Morgan Territory Road/Marsh Creek Road intersection (Station 51). The four stations are located approximately 5 miles from the project area and have a combined staff of 45, although not all are on duty at once. Station 54 is equipped with a four-wheel-drive power wagon, two water tenders, and two engines. Station 52 is equipped with a power wagon and two engines. Response times to the project area for both Stations 52 and 54 vary from 10 minutes to the northernmost areas to 20 minutes to the Alameda/Contra Costa County line. Station 53 on Marsh Creek Road is equipped with one engine and one power wagon and has comparable response times. The district responds to an average of two calls per week, which are mostly related to traffic accidents on the existing Vasco Road. (Hein pers. comm.) EDFPD receives funding from the county in the same manner as the BFPD with an apportionment factor of approximately 0.00044.

San Ramon Fire Protection District. SRFPD, which now includes the former Tassajara Fire Protection District, would provide first response to the southwestern portion of the Kellogg Creek watershed. Two stations in this district are near the western edge of the watershed. Station 36, on Camino Tassajara, has one engine, one patrol vehicle, one power wagon, and two water tenders. The response time from this

station is approximately 15-20 minutes. Several of these units have been upgraded recently (Probert pers. comm.).

Equipment at the Morgan Territory Road station consists of one engine, one patrol vehicle, and one water storage trailer. This station operates on a volunteer basis, with highly variable response times depending on availability of staff (Probert pers. comm). The district receives its funding in the same manner as the BFPD with an apportionment factor of approximately 0.00012.

California Department of Forestry and Fire Protection. CDF operates equipment from three locations in the area: the Sunshine Station on Marsh Creek Road, the Castle Rock Station west of Tracy, and the Sunol Station in Sunol. The Sunshine Station is equipped with two wildland fire engines; the Castle Rock Station with one wildland engine; and the Sunol Station with one structural engine, two wildland engines, and one bulldozer. The project area is approximately 15-20 minutes from the Sunshine Station, 25-30 minutes from the Castle Rock Station, and 30 minutes from the Sunol Station. (Elliff pers. comm.).

Although wildland fires are the responsibility of CDF, the high response times from these stations makes it unlikely that CDF equipment would be the first to arrive. Rather, EDFPD responds to any wildland fire calls in its jurisdiction and defers to CDF authority as its equipment arrives on the scene. The wildfire calls originating in the project area typically average from two to three per month from May through October, which is the critical fire season. Staffing at the CDF stations is reduced by 50-60% during the rest of the year because of the low incidence of fires. The majority of wildland fires are controlled by the time the first CDF equipment arrives. (Elliff pers. comm.)

Relevant General Plan Policies. The following Contra Costa County general plan fire protection policy is relevant:

7-81 Wildland fire prevention activities and programs such as controlled burning, fuel removal, establishment of fire roads, fuel breaks, and water supply, shall be encouraged to reduce wildland fire hazards.

Ambulance Service

The entire Kellogg Creek watershed area is served by the Regional Ambulance Company, which operates from five separate locations. One ambulance each responds from facilities in Livermore, Pleasanton, Dublin, Brentwood, and Antioch. The Brentwood unit, located at the intersection of SR 4 and Lone Tree Way, is the first to respond to calls in the Contra Costa County portion of the project area. If a second unit is required, the Antioch unit responds. The Brentwood and Antioch response times to the project area are 5-12 minutes and 14-21 minutes, respectively, depending on the location of the call. If a third ambulance is needed, the Livermore unit responds. (Bolt pers. comm.)

Calls from the Kellogg Creek watershed area are infrequent, averaging approximately three calls per week, and are almost exclusively traffic accident related. Depending on the severity of injuries, victims are either taken via ambulance to Valley Memorial Hospital in Livermore or are flown via helicopter to the trauma center at John Muir Medical Center in Walnut Creek (Jones & Stokes Associates 1990).

Relevant General Plan Policies. No general plan policies that address ambulance service are relevant.

Hospitals

Two hospitals serve the Kellogg Creek watershed and vicinity. Valley Memorial Hospital in Livermore receives patients requiring routine treatment via ground transport. The hospital has excess

emergency room capacity (Lee pers. comm.). Trauma patients are delivered to John Muir Medical Center in Walnut Creek via ground transport or helicopter. Last year, the trauma unit treated 1,200 critically injured patients and has the capacity to treat more. (Ryan pers. comm.). Apart from emergency room availability, the amount of vacant beds a hospital has at any given time is the most important factor in determining its capacity to treat patients. On the average, Valley Memorial Hospital has 42 beds available and John Muir Medical Center has 74 (American Hospital Association 1990).

Relevant General Plan Policies. No general plan policies that address hospitals are relevant.

Road Maintenance

Road maintenance for most public roads in the Kellogg Creek watershed and vicinity is the responsibility of the Contra Costa County Public Works Department. SR 4 is the only public roadway potentially affected by the alternatives that is maintained by the state.

Relevant General Plan Policies. No general plan policies that address road maintenance are relevant.

Desalination Plant Site

Except for one residence located in the southern half of the site, the site is vacant. The plant site is not within established service areas for sewer or water but is adjacent to the Oakley Sanitary District. The site is located in the Oakley Fire District and would be served by the Contra Costa County Sheriff's Department.

Construction of the desalination plant under the Desalination/EBMUD Emergency Supply Alternative would affect public facilities at the plant site and road maintenance. Solid waste either would be hauled by Oakley's collection service or would have to be taken to a transfer station by CCWD.

ENVIRONMENTAL CONSEQUENCES

Implementation of any of the alternatives would increase demand for public services in three ways. Trucks carrying heavy construction materials to construction sites would increase the need for road maintenance.. Under the reservoir alternatives, vegetation, structures, and asphalt from Vasco Road would be removed from the inundation area, which would affect solid waste facilities. Finally, recreationists visiting the reservoirs would increase demand for sewer service, water service, solid waste service, fire protection, law enforcement, and emergency medical service.

Because only a small portion of the Kellogg Creek watershed lies within Alameda County, and because no Los Vaqueros or Kellogg Reservoir Alternative facilities would be located in Alameda County, this section focuses on impacts that would occur in Contra Costa County.

Implementing the conceptual recreation plan would include building a section of trail within Alameda County and possibly using an existing dwelling as a ranger residence. Construction and operation of these facilities would not affect Alameda County public services because the Kellogg Creek watershed would be managed by CCWD as a unit. Almost all public services except ambulance service would be provided by CCWD or other contractors. The ambulance unit that responds to the Kellogg Creek watershed is stationed in Livermore.

Constructing the dam, transfer reservoir, conveyance, and intake facilities would involve transporting materials over roads that run through Alameda County. These routes would include Byron Highway and Vasco Road, which are both truck routes designed to support heavy loads of material such as those needed for construction of project alternatives (refer to the "Road Maintenance" section below). Therefore, these roads would not require any additional maintenance.

Criteria for Conclusions of Significance

Significant Impacts

Impacts of the alternatives on public services and facilities were considered significant if an alternative would cause a substantial increase in demand for any public service or facility, cause a substantial decrease in the level of service for any public service or facility, result in a substantial need for public services in an area not currently served by public service providers, or conflict with goals and policies of the Contra Costa County general plan. Impacts are also considered significant if alternative-related costs to public agencies would likely exceed general fund revenues generated by an alternative.

Beneficial Impacts

Impacts of the alternative on public services and facilities were considered beneficial if an alternative improved the level of service for any public service.

Less-than-Significant Impacts

Impacts of the alternatives on public services and facilities were considered less than significant if they were not beneficial or significant.

No-Action Alternative

If a project were not implemented CCWD would not require the presently owned Kellogg Creek watershed lands because all improvements to facilities would probably occur in the existing right-of-way for the Contra Costa Canal. For this assessment, it is assumed that CCWD would likely sell the watershed property at market value, returning watershed properties to the county property tax base. Growth would be assumed to continue as outlined in the Contra Costa County general plan. The general plan EIR estimates fiscal impacts at plan buildout to be beneficial: revenues are expected to exceed costs. The general plan EIR assumes that incremental public service requirements, such as fire and police protection, would be financed through special districts, county service areas, and fire facility fees (Contra Costa County Community Development Department 1991). The fiscal impact of implementing the No-Action Alternative would be less than significant because no public operating budgets would incur incremental costs greater than incremental revenues. No mitigation is required.

Los Vaqueros Reservoir Alternative

Impacts of Vasco Road and Utility Relocations

The closure of the existing Vasco Road alignment would increase emergency response times to many areas in the Kellogg Creek watershed and vicinity. Response time from CDF's Sunol Station could

be increased by as much as 15 minutes. This impact would be significant. CCWD adopted a mitigation measure that would increase the efficiency of response to wildland fires by reorganizing access areas after fire agency review of the local roadway network as it would exist after construction of the new Vasco Road alignment. This mitigation measure will reduce the impact to a less-than-significant level.

Construction-Related Impacts

Impacts of Dam and Reservoir Construction

Impacts on Solid Waste Disposal Service. Constructing the Los Vaqueros Reservoir would result in the removal of an estimated 3,000 cu yd of major structures, 5,500 cu yd of trees, and 10,000 cu yd of asphalt from the inundation area. Because of the shortage of landfill capacity in Contra Costa and Alameda Counties, CCWD would substantially reduce landfill capacity by disposing of this material. Therefore, this impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could deposit wood at a suitable wood waste recovery facility and use waste asphalt as roadbed material, deposit waste asphalt at a suitable waste recovery facility, or contract with Contra Costa County to use waste asphalt for roadbed material. These measures are discussed below in the "Mitigation Measures" section.

Impacts on Road Maintenance. Materials would have to be transported from Antioch, Brentwood, Tracy, Pleasanton, and other areas to be used in the construction of the Los Vaqueros dam, spillway, and related facilities. However, because the roads that would be used to transport materials are engineered to accommodate large trucks and would not be damaged by increased truck traffic, this impact would be less than significant. No mitigation is recommended.

Conveyance Pipeline and Transfer Reservoir Construction. One of seven possible alternate intake, conveyance pipeline, and transfer reservoir configurations would bring water from the Delta to the Los Vaqueros Reservoir. Because pipelines would be buried beneath major roadways and laid across minor roadways one lane at a time, and because traffic controls would be employed and pipelines would generally be routed around underground utility lines, the construction of the pipelines, intake facilities, and transfer reservoir would not substantially affect any public service except road maintenance.

No public services exist at the transfer reservoir or intake sites. Therefore, construction of these facilities would have no effect on public services.

Road Maintenance. Construction of the various pipeline alignments and transfer reservoirs would require that construction materials be transported along several roads. The routes not designed for truck use that would be followed for each pipeline alignment are indicated in Table 16-1. Because these routes could be damaged by truck traffic, this impact would be significant for all pipeline alignments. To reduce significant impacts to less-than-significant levels, CCWD could reroute material delivery trucks onto routes engineered to accommodate heavy truck traffic, or could repair damage to the routes if it were to occur. These measures are discussed below in the "Mitigation Measures" section.

Operation-Related Impacts

The construction and operation of recreation facilities in the Kellogg Creek watershed has the potential to increase the demand for public services and is therefore discussed below. Other operations of the Los Vaqueros Reservoir Alternative would not increase the demand for public services and are therefore not discussed.

CCWD has not yet finalized the design of the conceptual recreation plan facilities or programs. This section identifies significant impacts on sewer, water, drainage, solid waste, law enforcement, and fire protection services because recreation would substantially increase the demand for these services, and no

Table 16-1. Routes Affected by Alternate Los Vaqueros Reservoir Alternative Configurations That May Be Insufficiently Engineered to Accommodate Heavy Truck Traffic

Road	Old River No. 1	Old River No. 2	Old River No. 3	Old River No. 4	Old River No. 5	Old River No. 6	Clifton Court Forebay
Armstrong Road							X
Balfour Road		X	X				
Bixler Road		X	X	X	X	X	
Byron Hot Springs Road							X
Byron Tract access road	X	X			X	X	
Camino-Diablo Road	X				X	X	X
Clifton Court Road							X
Concord Avenue		X	X				
Creek Road		X	X	X			
Hoffman Road					X	X	
Marsh Creek Road			X	X	X	X	
Miscellaneous unpaved	X	X					
Orwood Road			X				
Point of Timber Road		X					
Sellers Avenue		X	X	X			

provision for them is included in the conceptual recreation plan. CCWD intends to identify how these services would be provided within the Kellogg Creek watershed and vicinity when finalizing the conceptual recreation plan. The district could ensure that these services would be provided by incorporating mitigation measures identified in this section into the final recreation plan.

Sewer Service. Implementation of the conceptual recreation plan would increase the amount of wastewater generated in the Kellogg Creek watershed. Sanitary facilities provided as part of the recreation plan would include portable restrooms, developed restrooms with flush toilets and showers, and floating restrooms located on the lake. The wastewater from all these facilities would have to be collected and transported to an appropriate treatment facility. CCWD has not identified available treatment capacity to dispose of wastewater generated within the Kellogg Creek watershed, which is typically required at the project approval stage by general plan policy 7-33 and sewer service implementation measure 7-t.

Because implementation of the project without identifying sewage disposal methods would be inconsistent with general plan policy 7-33 and sewer service implementation measure 7-t, this impact would be significant. To mitigate this impact to a less-than-significant level over the short term before substantial recreation facilities are constructed, CCWD could construct and operate vault toilets and a collection and disposal system. This measure would not be adequate to provide long-term sewage disposal service. Therefore, this may have to be combined with the construction and operation of a wastewater treatment plant and collection system or reservation of reserve capacity in future wastewater treatment facilities that may become available near the watershed in the future.

Water Service. Implementation of the conceptual recreation plan would increase demands for potable water supply. The plan specifies that potable water would be provided at all major recreation use areas. However, the plan does not specify whether adequate water quantity or quality exists to serve the project, as required by general plan policy 7-21. Water conservation measures that would be implemented as part of the project, as encouraged by policy 7-26, have yet to be identified.

Because implementation of the project without identifying a source of adequate potable water would be inconsistent with general plan policies 7-26 and 7-33, this impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could implement water conservation measures and drill and operate wells and construct and operate a distribution system, or construct and operate a water treatment plant and distribution system. These mitigation measures are discussed below in the "Mitigation Measures" section.

Drainage Improvements. Implementation of the conceptual recreation plan would increase demand for drainage improvements in the Kellogg Creek watershed. Impermeable surfaces such as paved parking lots, paved roads, and buildings would be constructed in the watershed to support recreation. Because the conceptual recreation plan does not describe what drainage facilities would be constructed to transport and dispose of runoff, this impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could construct drainage improvements where required. This measure is discussed below in the "Mitigation Measures" section.

Toxic materials (such as tire rubber and petroleum derivatives) that would be left by automobiles on parking lots and roads in the Kellogg Creek watershed would become "urban runoff" during rainstorms and enter the Los Vaqueros Reservoir. Because only a small portion of the area of the watershed would be covered with pavement, this impact would be less than significant. No mitigation is required.

Solid Waste Disposal Service. Implementation of the conceptual recreation plan would increase the generation of solid waste in the Kellogg Creek watershed. Based on the recreation activities and facilities that are described in Chapter 2 an estimated average of 4,000 recreationists would visit the site daily. Assuming an average of 3.7 pounds of solid waste generated per visit, which is the average generation rate per visitor day at Lake Del Valle (Balanda pers. comm.), approximately 14,800 pounds of solid waste per day would be generated by recreationists in this area. Therefore, recreation in Kellogg Creek watershed

would generate approximately 2,600 tons of solid waste per year. The recreation plan does not include a recycling program, which is encouraged by general plan policy 7-92.

Because of the lack of landfill space in Contra Costa County and because the lack of a recycling program is inconsistent with general plan policy 7-92, this impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could develop and implement a recycling program and negotiate a contract with Alameda County to accept solid waste. (These mitigation measures are discussed below in the "Mitigation Measures" section.) If Contra Costa County develops one of the new proposed landfills before a substantial amount of solid waste was generated, the impact would be less than significant.

Non-Traffic-Related Law Enforcement Service Impacts. Implementation of the conceptual recreation plan could increase crime (e.g., disturbing the peace, theft, automobile burglary, assault) in the Kellogg Creek watershed because of the increased concentration of people in the area. Also, the parking lots would be susceptible to automobile theft and burglary. The sheriff's department could continue to provide non-traffic-related law enforcement in the Kellogg Creek watershed and vicinity, which would increase the number of people by 4,000 in Beat 32, which is patrolled by one officer. One officer cannot adequately provide law enforcement service to approximately 14,000 people. Parking lots and isolated areas of the watershed also would require additional law enforcement service with project implementation. Because of funding shortages, the sheriff's department would not be able to finance additional personnel to augment inadequate enforcement in Beat 32. (Sherock pers. comm.)

Because the conceptual recreation plan would accommodate a visitor population too great to be effectively patrolled at the existing level of service, this impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could hire, train, and employ a law enforcement force; negotiate and implement a contract with the Contra Costa County Sheriff's Department for law enforcement service; or negotiate and implement a contract with EBRPD for law enforcement service. These measures are discussed below in the "Mitigation Measures" section.

Traffic-Related Law Enforcement Service Impacts. Implementation of the conceptual recreation plan would increase the amount of traffic on Vasco Road and other county roads patrolled by CHP. Peak traffic during peak recreation travel periods could approach 1,000 vehicle trips per hour. The frequency of drunk driving, speeding, and accidents near the reservoir would be expected to increase because of recreational use of the reservoir. The increased demand for traffic-related law enforcement is expected to result in a significant impact. To mitigate this impact to a less-than-significant level, CHP could hire one to two CHP officers to patrol Beat 053. This measure is discussed below in the "Mitigation Measures" section.

Fire Protection Service. Implementation of the conceptual recreation plan could increase the concentration of people in the watershed area using barbecues and fires, especially during summer, and thus would increase the potential for fire.

Within its boundaries, EBRPD maintains 10 fire engines that collectively have an average response time of 10-15 minutes. At Lake Del Valle, seven park rangers are certified to operate the recreation area's one engine (Dele Cruz pers. comm.). The district operates this engine to maintain a 10-minute response time when CDF's engine is traveling to fires in other parts of the state. Because CDF's engine travels intermittently to fires elsewhere in the state during fire season, it is even more important that EBRPD maintain an adequate fire response time. (Rubini pers. comm.)

The fire districts that respond to calls in the Kellogg Creek watershed typically do not travel to fires in other parts of the state. Currently, these districts maintain a response time to this area of between 10 and 15 minutes, which is comparable to the 10-minute response time maintained at Lake Del Valle.

Although CCWD has adopted an interim fire management plan (Contra Costa Water District 1989) to help prevent wildfires on lands that it acquires in the Kellogg Creek watershed, CCWD has not yet

adopted a program aimed at reducing wildland fire hazards related to recreation activities in the Kellogg Creek watershed. Activities such as controlled burning, fuel removal, and establishment of fuel breaks and water supply are encouraged by general plan policy 7-81. Because CCWD has not adopted such a long-term fire management program, implementation of the project would be inconsistent with general plan policy 7-81. This impact would be significant. To mitigate this impact to a less-than-significant level, CCWD could implement fire prevention measures including managing vegetation and establishing firebreaks and fire hydrants. This mitigation measure is discussed below in the "Mitigation Measures" section. No other mitigation is necessary, but CCWD could equip and train full-time permanent personnel to use basic firefighting equipment to ensure rapid response times.

Ambulance Service. Implementation of the conceptual recreation plan would increase the need for ambulance service in the Kellogg Creek watershed. The increased concentration of recreationists in hot weather or out on the reservoir would increase the probability of injuries or cardiovascular distress. Ambulance response times to the reservoir would be 10-15 minutes; a first-responder unit established in Byron would decrease this time further. Also, the recreation plan incorporates a helipad in its design that would be suitable for air ambulance use. Because of the relatively short response time to the reservoir and relatively low use of ambulance units in the area, this impact would be less than significant. No mitigation is necessary, but CCWD could train personnel in emergency medical techniques to ensure adequate emergency medical response.

Hospitals. Implementation of the conceptual recreation plan would probably increase the number of emergency medical cases at Valley and Delta Memorial Hospitals and John Muir Medical Center. Increased traffic from recreationists traveling to and from the reservoir could increase the number of vehicle accidents, and visitors at the reservoir may suffer other injuries. Because the hospital facilities serving the Kellogg Creek watershed have adequate bed capacity and do not anticipate substantial increases in their emergency caseload, this impact would be less than significant. No mitigation is recommended.

Operation-Related Impacts of the Intake Conveyance Pipeline and Transfer Reservoir Facilities

Operation of conveyance and transfer reservoir facilities would require employees to operate and maintain the equipment. Some additional car trips would be generated by these employees, but this number of trips would not require a substantial amount of road maintenance or any other public service. Therefore, this impact would be less than significant. No mitigation is required.

Impacts on County General Fund Revenues

Acquisitions of watershed lands and the effects on property tax revenues were evaluated in the Stage I Environmental Impact Report for the Los Vaqueros/Kellogg Project (Jones & Stokes Associates 1986). These effects were found to be a less-than-significant impact for all affected jurisdictions because of the small percentage of the budget that the property tax revenues represented in each jurisdiction. CCWD has also entered into agreement to make in-lieu payments to several affected jurisdictions.

Implementing the Los Vaqueros Reservoir Alternative would require the acquisition of additional conveyance route rights-of-way, which would result in a slight decrease to the county's property tax base. By comparison, the loss of the watershed lands from the county property tax rolls did not have a significant impact on county general fund revenues; conveyance route rights-of-way would constitute less than 350 acres.

Some of the land in the Kellogg Creek watershed may be leased out to private parties for grazing, windfarming, and possibly recreation activities. The private parties would then pay a possessory interest tax for private use of public property. The possessory interest tax is based on the value of the lease and levied at the same rate as the local property tax.

Implementing the Los Vaqueros Reservoir Alternative would result in a slight increase in possessory interest tax revenues to the county general fund. This amount is expected to be relatively small compared to property tax revenues derived from the same properties under private ownership, and would be a less-than-significant impact.

Implementing the Los Vaqueros Reservoir Alternative may result in a temporary increase in construction permit fees that may be required to construct various project facilities.

Implementing the Los Vaqueros Reservoir Alternative may result in increases in parking citations and fish and game fines because of the increased use of roadways and parking facilities near recreation areas and the fishing activities that would occur at the recreation area.

Impacts on County General Fund Expenditures

Implementing the Los Vaqueros Reservoir Alternative, specifically the conceptual recreation plan, would increase the need for public protection in the Kellogg Creek watershed because of the increased concentration of people in the area. According to the Contra Costa County Sheriff's Department, if the county were to provide these services, five additional officers would be required to patrol the area. Additional vehicles would also be required. Each of the additional officers would require an annual expenditure of approximately $70,000 from the county general fund public services category, resulting in a total annual cost of more than $350,000 to the county general fund. (Sherock pers. comm.).

Implementing the various pipeline alignments and transfer reservoirs would require transporting construction materials along several roads, including routes that could suffer damage from truck travel.

Implementing the Los Vaqueros Reservoir Alternative would result in incremental expenditures from the general fund public ways and facilities category for road maintenance.

Net Effect on the County General Fund

Implementing the Los Vaqueros Reservoir Alternative would result in slight increases and decreases to various general fund revenue sources. Overall, these changes are expected to offset each other. However, county general fund expenditures are expected to increase substantially because of the incremental law enforcement and road maintenance requirements. Given the county's budget shortfalls, this impact would be significant because of the negative net effect on the county general fund.

The mitigation measures specified above under "Construction-Related Impacts" and "Operation-Related Impacts" would also reduce impacts on the general fund to less-than-significant levels. These mitigation measures recommend alternative methods of providing law enforcement and road repair and would also mitigate the fiscal effect on the county general fund by directing CCWD to bear all costs associated with the requirements.

Impacts on Special Districts

Fire Protection Services. Implementing the conceptual recreation plan would increase the number of people in the watershed area who use barbecues, especially during summer, which would increase the probability of fire.

Fire district funding is derived from an allocation of locally generated property tax revenues. Other than a small amount of revenue generated by the possessory interest tax, properties owned by CCWD would not generate property tax revenues for fire district funding. CCWD has entered into memorandums of

agreement with the districts that serve the Kellogg Creek watershed to pay the districts in-lieu fees matching lost property tax revenues. However, direct property tax revenues represent a relatively small portion of district budgets and would not offset increased costs attributable to increased service requirements in the Kellogg Creek watershed resulting from increased recreation.

Implementing the Los Vaqueros Reservoir Alternative would result in a significant impact on the local fire districts because costs generated by the recreation-based demand for services would likely exceed increases in revenues.

This impact could be reduced to a less-than-significant level if CCWD implemented fire prevention measures, including managing vegetation and establishing fire breaks and fire hydrants.

Kellogg Reservoir Alternative

The analysis of this alternative assumes that a recreation plan similar to the conceptual recreation plan for the Los Vaqueros Reservoir Alternative would be implemented.

Impacts of Vasco Road and Utility Relocations

Impacts under this alternative would be identical to those described above under the Los Vaqueros Reservoir Alternative.

Construction-Related Impacts

Impacts would be similar to those discussed in the "Impacts Related to Project Construction" section above under the Los Vaqueros Reservoir Alternative.

- Solid waste disposal service would be affected by the vegetation and asphalt that would have to be removed from the reservoir inundation zone.

- Road maintenance needs could be increased by trucking materials needed to build the Old River No. 5 pipeline alignment over roads not designed for heavy truck traffic (Table 16-1).

These impacts would be significant for the reasons described above under the Los Vaqueros Reservoir Alternative. Mitigation measures described for these impacts under the Los Vaqueros Reservoir Alternative would reduce impacts on solid waste disposal service and road maintenance to less-than-significant levels.

Operation-Related Impacts

Implementation of this alternative would have impacts similar to those of the Los Vaqueros Reservoir Alternative. A recreation plan would be implemented at the Kellogg Reservoir that would have impacts similar to those discussed in the "Operation-Related Impacts" section above under the Los Vaqueros Reservoir Alternative. Recreation at the reservoir would have significant impacts on the following public services:

- sewer service,
- water service,
- drainage,
- solid waste service,

- law enforcement service, and
- fire protection.

Impacts on County General Fund Revenues

Because of the similarities of this alternative to the Los Vaqueros Reservoir Alternative, the fiscal impacts are considered to be similar to those described under the Los Vaqueros Reservoir Alternative and would be significant because the net effect on the county general fund and local fire districts would be a substantial increase in expenditures.

Mitigation measures recommended for the Los Vaqueros Reservoir Alternative would be adequate to reduce impacts to less-than-significant levels under this alternative.

Desalination/EBMUD Emergency Supply Alternative

Construction-Related Impacts

Public services other than road maintenance would not be affected by this alternative for the reasons described in the "Impacts of Conveyance Pipeline Alternatives" section under the Los Vaqueros Reservoir Alternative. Pipeline construction would not require rerouting of major utility lines and would interrupt traffic flow only on minor roads. Also, the only public service facilities existing at the desalination plant site are to serve the solitary residence. These facilities would either be removed during plant construction or be used to support operation of the desalination plant.

Implementation of this alternative would require the transport of construction materials along several roads. Because these roads are truck routes and would presumably not be damaged by truck traffic, this impact would be less than significant.

Operation-Related Impacts

Operation of the project would have little impact on public services. Approximately 25 employees would be required to operate the plant (Martin pers. comm.). Additional demands for law enforcement, fire protection, sewer, water, and solid waste service would not require substantial increases or alterations of existing levels of service. This impact would be less than significant.

Impacts on County General Fund Revenues

As under the No-Action Alternative, for this alternative it is assumed that CCWD would sell watershed lands, resulting in an increase in property tax revenues to the county general fund and special districts that derive funding from property tax revenues.

Constructing the desalination plant would also require the purchase of the 99-acre site, resulting in the slight decrease in property tax revenues currently generated by this property.

Because the net change in the property tax base with the sale of watershed lands and purchase of the desalination plant sites would be positive, implementing the Desalination/ EBMUD Emergency Supply Alternative would result in greater increases in revenues than expenditures to the county general fund. This impact would be less than significant. No other revenue sources or expenditure categories would be substantially affected by this alternative. No mitigation is required.

Middle River Intake/EBMUD Emergency Supply Alternative

Construction-Related Impacts

Public services other than road maintenance would not be affected by this alternative because of the reasons described in the "Impacts of Conveyance Pipeline Alternatives" section under the Los Vaqueros Reservoir Alternative.

Implementation of this alternative would require the transport of construction materials along several roads not designed for heavy truck traffic. These routes include Orwood Road, Eden Plains Road, Sellers Avenue, Sunset Road, Lone Tree Way, and Neroly Road. Because all these routes could suffer damage from truck travel, this impact would be significant. To reduce this impact to a less-than-significant level, mitigation measure discussed below in the "Mitigation Measures" section under the Los Vaqueros Reservoir Alternative could be implemented.

Operation-Related Impacts

No impacts or public services would be associated with operation of facilities under this alternative.

Impacts on County General Fund Revenues

As under the No-Action Alternative, this alternative assumes that CCWD would sell watershed lands, which would result in an increase in property tax revenues to the county and special districts that derive funding from watershed property tax revenues. Easements would be purchased along pipeline and conveyance routes to accommodate conveyance facilities; however, easements would not affect property tax revenues generated by private properties affected by conveyance routes.

Increased road maintenance costs would be incurred because construction materials would be transported along several roads, including nontruck routes that could suffer damage from truck travel. These temporary expenditures would be charged to the county general fund public ways and facilities expenditures category. The increased road maintenance costs, however, would likely be more than offset by new property tax revenues generated by the return of watershed lands to the property tax base.

Implementing the Middle River Intake/EBMUD Emergency Supply Alternative would result in a less-than-significant impact on the county general fund. No mitigation is required.

MITIGATION MEASURES

Los Vaqueros Reservoir Alternative

Solid Waste Disposal Service

16-1: Deposit Wood Waste at a Suitable Wood Waste Recovery Facility. To mitigate the impacts of wood waste generation, CCWD could recycle wood waste at one of the wood waste recovery facilities in the county. Waste Fibre Recovery owns and operates such a facility located in the Oakley/Antioch area. This facility is probably the closest to the watershed and would have capacity to process the 8,500 cu yd of wood waste that CCWD would generate in preparing the inundation area. The fee for depositing the wood material at this facility would also likely be smaller than for depositing it in a landfill (Lobese pers. comm.).

This mitigation measure should be implemented during construction of the main Los Vaqueros dam. CCWD would be responsible for monitoring the success of this measure.

16-2: Recycle Waste Asphalt. Three measures are available that would either individually or in combination reduce impacts of producing waste asphalt from the existing Vasco Road to less-than-significant levels.

16-2a: Use Waste Asphalt as Roadbed Material. CCWD could recycle the asphalt as it is removed from the ground. As the material is removed, it can be dumped into a portable asphalt grinder and trucked away to be reused for the parking lots, roads, and other paved areas constructed as part of the conceptual recreation plan (Pope pers. comm.).

This mitigation measure should be implemented during construction of the main Los Vaqueros dam, transfer reservoir, conveyance pipeline, and conceptual recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

16-2b: Deposit Waste Asphalt at a Suitable Waste Recovery Facility. CCWD could recycle the waste asphalt at the waste asphalt recovery facility located in San Jose. The Raisch Company owns and operates this facility, which grinds concrete and asphalt chunks into manageable pieces. This material then can be reused as roadbed material or for other construction. The facility has sufficient capacity to accommodate the 10,000 cu yd of waste asphalt generated during construction of the project. (Pope pers. comm.)

This mitigation measure should be implemented during construction of the main Los Vaqueros dam. CCWD would be responsible for monitoring the success of this measure.

16-2c: Contract with Contra Costa County to Use Waste Asphalt for Roadbed Material. CCWD could sell the waste asphalt to Contra Costa County. The material may be useful for constructing the roads for Contra Costa County's proposed new landfills. The transport costs to these sites would probably be smaller than if CCWD trucked the material to the asphalt recycling facility in San Jose. (Nicholson pers. comm.)

This mitigation measure should be implemented during construction of the main Los Vaqueros dam, transfer reservoir, and conveyance pipeline facilities. CCWD would be responsible for monitoring the success of this measure.

Road Maintenance

16-3: Minimize and Repair Damage to Routes not Designed for Heavy Truck Traffic. Two measures are available that would either individually or in combination reduce this impact to less-than-significant levels.

16-3a. Reroute Material Delivery Trucks onto Appropriate Routes. CCWD could, whenever possible, reroute trucks onto routes designed for heavy truck traffic. During construction, material to be used for the project should be transported across truck routes to avoid damage to roads not built to support heavy trucks (weighing 20 tons or more).

This mitigation measure should be implemented during construction of the main Los Vaqueros dam, transfer reservoir, and conveyance pipeline facilities. CCWD would be responsible for monitoring the success of this measure.

16-3b: Repair Damage to Roads not Designed to Withstand Heavy Truck Traffic. To mitigate the impact of damage to roads not designed for heavy truck traffic, CCWD could repair, or finance the repair, of damage to these roads resulting from the trucks transporting materials necessary for pipeline

construction. Before construction, the Contra Costa County Public Works Department and CCWD should survey the routes that would be used to transport materials to determine road condition. After construction, the amount of damage should be assessed against this baseline road condition.

This mitigation measure should be implemented during construction of the main Los Vaqueros dam, transfer reservoir, and conveyance pipeline facilities. CCWD would be responsible for monitoring the success of this measure.

Sewer Service

Identify and Implement Sewage Treatment Solutions. Two measures would be required to mitigate impacts to less-than-significant levels.

16-4: Construct and Operate Vault Toilets. To mitigate the impacts of increased wastewater generation over the short term, CCWD could install vault toilets in the Los Vaqueros recreation area and collect and dispose of effluent. Wastewater deposited into a vault toilet system remains in a sealed vault until it is retrieved and transported to a treatment facility. Only initial facilities, and some future phase facilities could use a vault system. CCWD would have to acquire vehicles or a contractor to collect the wastewater and transport it to a treatment plant located outside the watershed.

This mitigation measure should be implemented for initial recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

16-5: Construct and Operate a Wastewater Treatment Plant and Collection System or Reserve Capacity in Future Nearby Wastewater Collection and Treatment Facilities. To mitigate the long-term impacts of increased wastewater generation, CCWD could construct and operate a wastewater treatment plant and collection system to process wastewater generated in the Los Vaqueros Recreation Area. The plant should be designed with capacity sufficient to treat the amount of wastewater expected during weekend peak visitation periods. The plant should be located in an area where noise, odors, or viewshed degradation would not conflict with recreation uses or any other surrounding land uses. If deemed feasible, treated effluent could be used for landscape irrigation, fire hydrants, and other nonpotable water uses in the recreation area or vicinity. To be consistent with health requirements and water quality goals, effluent reclaimed for these uses should be treated to at least a tertiary level.

Alternatively, CCWD could reserve capacity in future wastewater treatment facilities that may be located near the Kellogg Creek watershed if development identified in the Contra Costa County general plan occurs. This measure would include a collection system to gather wastewater from all disposal points and a connection either directly to a wastewater treatment plant, or to a local sewer interceptor with adequate capacity.

Either of these mitigation measures should be implemented when warranted by the level of user demand. CCWD would be responsible for monitoring the success of this measure.

Water Service

Two measures would be required to reduce impacts to less-than-significant levels.

16-6: Implement Water Conservation Measures. To mitigate the impact of increased water demand, CCWD could implement water conservation measures in the Los Vaqueros Recreation Area. Low-flow showerheads, toilets, and faucets should be used. All valves should have automatic shut-off features to the extent feasible. Drought-tolerant landscaping (preferably native) should be used.

This mitigation measure should be implemented during construction of the recreation facilities. CCWD would be responsible for monitoring the success of this measure.

16-7: Drill and Operate Wells and Construct and Operate a Distribution System or Construct and Operate a Water Treatment Plant and Distribution System. To mitigate the impact of increased water demand, CCWD could drill and operate wells and construct and operate a distribution system to supply the Los Vaqueros Recreation Area with adequate water supply. The wells should have sufficient capacity to supply potable water to meet the demand generated during weekend peak visitation periods. Treatment devices should be added to wells when necessary to meet state and federal drinking water standards. The wells and treatment devices should be maintained and operated adequately. A distribution system that would serve all designated water supply points should be installed, maintained, and operated adequately.

Without the concurrent implementation of mitigation measure 16-6, this mitigation measure would be inconsistent with general plan policy 7-26.

Alternatively, CCWD could construct and operate a water treatment plant and distribution system to provide the Los Vaqueros Recreation Area with adequate water supply. The treatment plant should have sufficient capacity to supply potable water to meet the demand generated during weekend peak visitation periods. A distribution system that would serve all water supply points should be installed, maintained, and operated adequately.

This mitigation measure should be implemented during construction of the recreation facilities. CCWD would be responsible for monitoring the success of this measure.

Drainage Improvements

16-8: Construct Drainage Improvements. To mitigate the impact of increased drainage flows, CCWD could design and construct recreation plan facilities with appropriate sloped surfaces and ditches to transport runoff generated in the Los Vaqueros Recreation Area to the reservoir.

This mitigation measure should be implemented while CCWD develops a final recreation plan and during construction of the recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

Solid Waste

Two measures would be required to reduce impacts to less-than-significant levels.

16-9: Develop and Implement a Recycling Program. CCWD could develop and implement a recycling program to recover recyclable waste generated in the Los Vaqueros Recreation Area. The recyclable wastes collected should include, but not be limited to, "CA redemption value" marked glass and aluminum beverage containers. These materials should be collected and hauled to a suitable recycling facility. For this purpose, CCWD should place containers for glass and aluminum at all points where solid waste would be generated, such as campgrounds, picnic areas, and cafeterias.

This mitigation measure should be implemented while CCWD develops a final recreation plan and during construction and operation of the recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

16-10: Negotiate a Contract with Alameda County to Accept Solid Waste or Deliver Solid Waste to a New Contra Costa County Landfill. To mitigate the impact of increased solid waste generation, CCWD could negotiate a contract with Alameda County to accept solid waste generated in the Los Vaqueros Recreation Area.

CCWD could also adopt a method of solid waste collection. The district could negotiate a contract with a solid waste collection agency to transport solid waste generated in the Los Vaqueros Recreation Area to the Alameda County landfill. If no collection agency were available, CCWD would have to deliver solid waste to the landfill by hiring appropriate personnel and equipment.

Alternatively, CCWD could deliver solid waste generated in the Los Vaqueros Recreation Area to one of the two new Contra Costa County landfills if one or both of these landfills open before the recreation area is scheduled to open.

Without concurrent implementation of mitigation measure 16-9, this mitigation measure would be inconsistent with general plan policy 7-26.

This mitigation measure should be implemented during construction and operation of the recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

Law Enforcement

16-11: Provide Non-Traffic-Related Law Enforcement. Three measures are available that would reduce impacts of increased non-traffic-related law enforcement needs to less-than-significant levels.

16-11a: Employ and Train a Law Enforcement Force. CCWD could employ and train a law enforcement force to provide law enforcement protection within the Los Vaqueros Recreation Area. Staffing needs should be determined in consultation with EBRPD and the sheriff's department. CCWD should staff a boat patrol with at least one officer when the lake is open to public use and employ at least one ground-based officer at all times. Staff should be increased by one or two officers during heavy-use periods depending on the level of visitation.

Use of Lake Del Valle (5,000-6,000 visitors per day) is comparable to the level of use estimated for Los Vaqueros Reservoir. At Lake Del Valle, EBRPD employs two full-time law enforcement officers to patrol the recreation area. Typically, one officer is assigned to patrol by boat and the other by vehicle (Dele Cruz pers. comm.). These officers are specially trained to patrol a recreation population and to respond to emergencies using various modes of transportation, including four-wheel-drive vehicles, motorcycles, horses, boats, and by foot. Also, they may be trained to protect resources from degradation by visitors. (Sarna pers. comm.)

This mitigation measure should be implemented and during operation of the recreation facilities. CCWD would be responsible for monitoring the success of this measure.

16-11b: Negotiate and Implement a Contract with the Contra Costa County Sheriff's Department for Law Enforcement Service. CCWD could negotiate and implement a contract with the sheriff's department to provide law enforcement services within the Los Vaqueros Recreation Area. The sheriff's department recommends that as many as five officers may be needed to effectively patrol the recreation area during peak visitation periods averaging 6,000-7,000 visitors. These officers would use several modes of transportation. Two would be on motorcycles, two on a boat patrol, and one in a four-wheel-drive vehicle. Two or more of these personnel could be reserve officers who would only work during peak visitation periods. (Sherock pers. comm.)

This mitigation measure should be implemented during operation of the recreation facilities. CCWD would be responsible for monitoring the success of this measure.

16-11c: Negotiate and Implement a Contract with the East Bay Regional Park District for Law Enforcement Service. CCWD could negotiate and implement a contract with EBRPD to provide law enforcement services within the Los Vaqueros Recreation Area. A minimum of two officers would

probably be necessary to provide adequate law enforcement within the Los Vaqueros Recreation Area as discussed above. Final determinations concerning staffing should be made in consultation with EBRPD.

This mitigation measure should be implemented and during operation of the recreation facilities. CCWD would be responsible for monitoring the success of this measure.

Traffic-Related Law Enforcement

16-11: California Highway Patrol Should Hire One or Two California Highway Patrol Officers to Patrol Beat 053. To mitigate the impact of increased need for traffic-related law enforcement, CHP could hire one or two additional officers to patrol Beat 053 after the implementation of the conceptual recreation plan. Increased incidence of traffic accidents and need for traffic control would necessitate the employment of these additional officers. (Velmen pers. comm.).

This mitigation measure should be implemented during construction and operation of the recreation plan facilities. CHP would be responsible for monitoring the success of this measure.

Fire Protection Service

16-12: Implement Fire Prevention Measures. To mitigate the impact of increased need for fire protection, CCWD could establish and maintain fire prevention measures to reduce fire hazards in the Los Vaqueros Recreation Area. Throughout the Kellogg Creek watershed, the district should maintain a vegetation management program at an intensity sufficient to substantially decrease fire hazards, but consistent with preserving ecological systems. Fire breaks should be constructed and maintained at least during the dry season. Campgrounds should have fire hydrants spaced at regular intervals, maintained clearance around all fire rings and barbecues, and restrictions on campfire use according to the CDF fire danger level. Placement of all fire prevention improvements and implementation of all fire prevention programs should be supervised and approved by CDF and EDFPD.

This mitigation measure should be implemented while CCWD develops a final recreation plan and during construction and operation of the recreation plan facilities. CCWD would be responsible for monitoring the success of this measure.

County General Fund and Special Districts

Implementing mitigation measures 16-3, 16-10, and 16-12 would reduce the impacts on the county general fund and special districts discussed above in the "Environmental Consequences" section to less-than-significant levels.

Kellogg Reservoir Alternative

All mitigation measures recommended above under the Los Vaqueros Reservoir Alternative would also reduce the impacts of this alternative to less-than-significant levels.

All Other Alternatives

No mitigation is required.

Chapter 17. Relationship of the Los Vaqueros Project to Other CCWD Planning

INTRODUCTION

As part of its normal operations, CCWD holds discussions with potential customers and occasionally engages in water supply alternative planning processes with municipalities, other water suppliers, and large development planners. Recently, CCWD has participated in discussions with Byron-Bethany Irrigation District, the Town of Byron, the Discovery Bay Development, ECCID, and the Planned Mountain House Development. This chapter describes general issues associated with possible CCWD service to areas outside its planning area as they relate to the Los Vaqueros Project.

This chapter focuses on the issues associated with possible future CCWD service to areas in east Contra Costa County that are in ECCID but outside the area used to develop CCWD's buildout water demands in Chapter 1, because discussions between CCWD, ECCID, and the City of Brentwood are sufficiently developed to allow a reasonable analysis of issues. This chapter also describes the relationship of such service to the alternatives discussed in this EIR/EIS.

The objectives of this discussion are to:

- describe discussions that are ongoing regarding potential CCWD service to an expanded east county service area;
- recognize that providing project-related water quality and reliability benefits to an expanded east county service area without also expanding the appropriate facilities could reduce benefits to the rest of CCWD's customers;
- recognize that CCWD is committed to providing water from its existing supply sources to meet future demands in its present service area/SOI and that extending service to east county would not occur without a supplemental water supply in addition to existing supplies;
- recognize that project-related benefits to an expanded east county service area could not be provided without a supplemental EIR or other CEQA (and possibly NEPA) document, and that CCWD is not proposing that the alternatives included in this EIR/EIS be used to provide these water quality and reliability benefits to an expanded east county service area other than as discussed in Chapter 1; and
- acknowledge that minor CCWD SOI changes and general plan amendments will continue into the future and that minor changes may be able to be accommodated without compromising the project goals.

Most of eastern Contra Costa County is not within the CCWD boundaries; residents outside these boundaries did not vote on the ballot measure that authorized bond funding for the Los Vaqueros Project and are not being charged to repay project bond funding.

The analyses in this chapter are provided to address issues concerning possible service with an additional supply and benefits to an expanded east county service area. Because of the conceptual nature of planning efforts at this time, no specific water quantities, service areas, or timing of service to an expanded east county service area can be identified.

Possible service to an expanded east county service area would be a separate action from the project alternatives. However, for clarification, the relationship between possible CCWD water service to an expanded east county service area and the Los Vaqueros Project is addressed below.

WATER SERVICE TO EXPANDED EAST COUNTY AREA

CCWD has entered into an agreement with ECCID, dated May 16, 1990. This agreement allows up to 21,000 af/yr of ECCID water, presently used for irrigation and incidental domestic uses, to be transferred to CCWD for treatment and distribution over the next 20 years to municipal and industrial customers within ECCID's state-authorized place of use. Use of this water for municipal and industrial purposes will occur only if and when land in ECCID's place of use changes from agricultural to municipal and industrial uses.

ECCID holds pre-1914 appropriative rights to divert water from Indian Slough in the Delta. Substantial new facilities would need to be constructed before a significant amount of this water could be made available for municipal and industrial uses, and CCWD would need to expand its service area by annexing lands that are within ECCID's state-authorized place of use but outside CCWD's service area. Both of these actions would require compliance with CEQA.

CCWD has also entered into an agreement with the City of Brentwood, dated November 14, 1990, indicating that CCWD may, at some future time and subject to certain conditions, supply the city with treated water. The city is in the ECCID service area. No beginning date for this service has been set, and no detailed plans to provide service have been developed. Providing CCWD service to Brentwood would require the construction of a substantial number of new facilities and the annexation of lands. Los Vaqueros Project planning does not include providing the additional facility capacity necessary to provide project-related water quality and reliability benefits to an expanded service area in eastern Contra Costa County.

Service to an expanded east county service area, including Brentwood, cannot occur without CEQA compliance. Both the City of Brentwood and CCWD recognized the CEQA compliance requirement in their agreement:

> For the purpose of complying with CEQA, each party shall be the lead agency with respect to the installation of its facilities. Brentwood shall be responsible for environmental documentation of the impacts of water delivered to Brentwood and the facilities to be constructed for Brentwood's exclusive use. The parties' obligations hereunder shall be subject to carrying out all responsibilities and determinations required by CEQA.

The agreement also requires that the city make effective use of groundwater and evaluate and develop, if feasible, secondary nonpotable sources, which may include wastewater reclamation groundwater and untreated Delta water. The relative quantities of water to be developed by or provided to Brentwood are not defined in the agreement. Information is insufficient on such issues as water supply quantities, diversion timing, conjunctive use of existing groundwater, and wastewater reclamation, precluding a complete analysis in this document.

Sizing of Alternative Facilities

The preliminary design and sizing of facilities associated with the alternatives described in this EIR/EIS are based on providing water quality and reliability benefits only to the planning area defined in Chapter 1. Areas outside this planning area, including other east county areas, were not considered potential areas to receive benefits. Using the alternatives as now configured to provide water quality and reliability benefits to an expanded east county service area would reduce the benefits that would otherwise

be obtained in the current CCWD planning area. The question of facility sizing has been addressed by CCWD previously, and CCWD decided that the alternatives should not be sized to serve the east county area for the following reasons:

- voters in the ECCID service area could not vote on the ballot measure authorizing CCWD to issue bonds for the Los Vaqueros Project,
- the project was not planned to provide benefits to areas outside the CCWD planning area, and
- CCWD service to an expanded east county area would require developing an additional water supply.

This issue was also discussed briefly at the CCWD Board of Directors meeting on December 4, 1989, with the resulting consensus that Los Vaqueros Project planning should assume that the east county area would not receive project-related benefits.

Relationship of Facilities

The physical linkage of the facilities is an important aspect of the potential relationship between the two actions. The ECCID water supply for Brentwood and an expanded east county service area that would be supplied through CCWD facilities could be diverted from the Delta at the Rock Slough intake, flow into the Contra Costa Canal through the four pumping plants, and leave the canal at the turnout for the Randall-Bold Water Treatment Plant. After treatment at the plant, the treated water could be piped to Brentwood.

All the alternatives discussed in this EIR/EIS would connect to the Contra Costa Canal immediately downstream of pumping plant no. 4. Thus, when the project is being used to provide water quality benefits to CCWD's current planning area, the water quality in the canal is improved, the water quality at the Randall-Bold Water Treatment Plant is improved, and project water quality benefits would reach an expanded east county service area.

Provision of reliability benefits to an expanded east county service area could occur in the same way, although CCWD could decline to provide water to these areas if, for any reason, the water is unavailable at the Rock Slough intake. Whether CCWD would decline to serve these areas if an emergency or drought were to reduce or eliminate the Rock Slough supply is problematic, but the issue would be resolved by political action if it were to arise, depending on prevailing facts, attitudes, and political decisions.

Because the water deliveries for an expanded east county service area would increase Contra Costa Canal flows, the water quality and reliability benefits to CCWD's current planning area from blending better quality project water would be reduced.

Unless the system in this reach of the Contra Costa Canal were physically altered to separate water for an expanded east county service area from water for CCWD's current planning area, the east county area would benefit from the project, and CCWD's current planning area would experience a decline in water quality benefits because of the mingling of the water in the Contra Costa Canal.

No additional water supply yield would be created by providing project benefits to an expanded east county service area; supplies would come from a reassignment of ECCID or other new supplies from agricultural to urban uses. The existing contract between CCWD and Reclamation for 195,000 af/yr is sufficient only for service to the planning area described in Chapter 1.

Chapter 18. Cumulative and Growth-Related Effects

APPROACH TO CUMULATIVE IMPACT ANALYSIS

Legal Requirements

State CEQA Guidelines and NEPA regulations require that the cumulative impacts of a proposed project be addressed in the EIR/EIS when the cumulative impacts are expected to be significant (14 CCR 1530[a], 40 CFR 1508.25[a][2]). Cumulative impacts are impacts on the environment that result from the incremental impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions (14 CCR 15355[b], 40 CFR 1508.7). These impacts can result from individually minor but collectively significant actions taking place over time.

Section 15130 of the State CEQA Guidelines states that the discussion of cumulative impacts need not provide as much detail as the discussion of effects attributable to the project alone. The level of detail should be guided by what is practical and reasonable.

Methodology

According to the State CEQA Guidelines (Section 15130), an adequate discussion of cumulative impacts should contain the following elements:

- an analysis of related future projects or planned development that would affect resources in the project area similar to those affected by the proposed Los Vaqueros Project;
- a summary of the expected environmental effects to be produced by those projects with specific references to additional information and the sources of the information; and
- a reasonable analysis of the cumulative impacts of the relevant projects and an examination of reasonable options for mitigating or avoiding the significant cumulative effects of a proposed project.

To identify the related projects, the State CEQA Guidelines (14 CCR 15130[b]) recommend either:

- the list approach, which entails listing past, present, and reasonably anticipated future projects producing related or cumulative impacts, including those projects outside the control of the agency, or
- the projection approach, which uses a summary of projections contained in an adopted general plan or related planning document that is designed to evaluate regional or areawide conditions.

This cumulative impact analysis identifies the related projects generally using the list approach; however, the list includes Contra Costa County's adopted general plan of 1991 as one of the projects.

Buildout of the Contra Costa County general plan was determined to be an appropriate baseline for discussing proposed development in the project area. Because, however, several other major projects that

potentially affect some of the same types of resources have been recently proposed and are not included in the general plan, these projects are also considered in this cumulative impacts analysis. The analysis includes, for each resource, a discussion of the expected cumulative environmental effects of the related projects to which the Los Vaqueros Project would contribute. The projects analyzed are:

- the Contra Costa County general plan projected development,
- other CCWD planned water system improvements,
- the proposed Delta Expressway project,
- the proposed Mid-State Tollway project,
- the East Contra Costa County Airport project.

There is significant doubt whether the proposed Mid-State Tollway can be classified as reasonably foreseeable. To include in the analysis other projects beyond the projected buildout scenario of the general plan and those listed above, substantial speculation regarding the type, intensity, and location of future development would be required. Section 15145 of the State CEQA Guidelines relieves agencies from engaging in such speculation and indicates that EIRs should focus on those effects that can be readily analyzed. A brief description of each of the related projects included in the cumulative impacts analysis is presented below.

The State CEQA Guidelines state that the discussion of cumulative impacts need not provide as much detail as the discussion of effects attributable to the project alone. The level of detail should be guided by what is practical and reasonable. Because of the lack of quantitative information available on the effects of other proposed projects (described below) in east county, and because CEQA does not hold agencies responsible for analyzing all other related projects in detail, the following discussion of cumulative impacts is qualitative.

Cumulative impacts for water resources, water quality, fisheries, transportation, and air quality are not addressed in this chapter because they are discussed in detail in Chapters 3, 4, 5, 13, and 14, respectively. Cumulative impacts on other resources were evaluated based on the methodology described above and are presented below under "Cumulative Impacts".

OTHER PROJECTS AND THEIR RELATIONSHIP TO THE LOS VAQUEROS PROJECT

Adopted Contra Costa County General Plan

The general plan is a comprehensive, long-term document that guides future development in Contra Costa County. Nine specific elements comprise the general plan, including land use, circulation, housing, public facilities and services, conservation, open space, noise, safety, and growth management.

The land use element of the general plan designates the general distribution and intensity of uses of land throughout Contra Costa County for housing, business, industry, open space, natural resources, public facilities, waste disposal sites, and other categories of public and private uses.

The circulation element identifies the general location and extent of existing and proposed streets, arterials, highways, transportation routes, terminals, and other local public utilities and facilities throughout the county, all correlated with the land use element.

The housing element contains a comprehensive assessment of current and projected housing needs for all segments of the county's population; a list of policies to address these needs; a statement of goals, policies, quantified objectives, and scheduled programs for the preservation, improvement, and development

of housing; and a 5-year housing action program that includes an inventory of specific programs to implement the goals and policies.

The public facilities element states policies related to the levels of service to be provided for water, sewage, parks, education, fire protection, and other services, and establishes boundaries for service areas.

The conservation element addresses the conservation, development, and use of natural resources throughout the county, including water, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources.

The open space element details plans and measures for preserving open space areas to manage the production of resources, to provide outdoor recreation, and to preserve public health and safety, and identifies important agricultural lands in the county.

The noise element identifies and appraises noise problems within the county; analyzes, quantifies, and maps current and projected noise levels; and provides coordination with the land use element.

The safety element establishes policies and programs to protect Contra Costa County and its residents from risks associated with seismic, geologic, flood, wildfire, and other hazards.

The growth management element relates to the physical development of the county and is internally consistent with the other general plan elements.

Most of east county is outside the proposed urban limit line (described in Chapter 12, "Human Environment") designated on the general plan map.

Other CCWD Planned Water System Improvements

CCWD's Treated Water Master Plan, completed in 1987 by James M. Montgomery Consulting Engineers, made recommendations regarding CCWD's capital improvements for the 5-year period that followed the completion of the document, and made generalized recommendations regarding capital improvements required to meet full buildout demands. For the 5-year capital improvements plan, the report recommended that 13 small treated-water reservoirs capable of storing a maximum of 15.9 million gallons be constructed to serve new development, along with 58,600 feet of distribution mains and several associated pumping plants.

To serve eventual buildout beyond 1992, the report recommended that nine new small storage reservoirs, 65 miles of distribution mains, five new pumping plants, and modifications to six existing pumping plants be constructed.

Because the report is outdated and is being revised, implementation of improvements to the treated water service area will probably be different than the recommendations in the report. The report, however, does convey the magnitude of treated water service improvements required to serve buildout demands.

CCWD is now constructing the Randall-Bold Water Treatment Plant in Oakley. The facility's initial capacity is 40 mgd, with 15 mgd allocated to the Oakley Water District and 25 mgd allocated to CCWD. The plant is scheduled for startup in 1992, but treated water service to CCWD would not commence until 1995 or later. Expansion of the plant's capacity to 80 mgd to meet the foreseeable projected demand for both districts is expected to be necessary by the year 2002.

Because of capacity constraints at various points in the Contra Costa Canal, the canal will require various upgrades. Even without construction of any of the alternatives discussed, the canal upstream of

pumping plant no. 4 would need to be widened and the four canal pumping plants modified to convey the additional water supplies that would be required under buildout. In addition, expansion of several canal reaches downstream of pumping plant no. 4 would be required.

Because the Los Vaqueros Reservoir and Kellogg Reservoir and Middle River Intake/EBMUD Emergency Supply Alternatives would involve constructing a new Delta intake and conveying water supplies to a point downstream of pumping plant no. 4, no modifications of the Contra Costa Canal would be required upstream of this point under these alternatives. Only canal modifications downstream of pumping plant no. 4 would be made.

At this point, identifying the locations of all future improvements and additions CCWD will make to its water service facilities in the next 2 decades is impossible. In general, CCWD provides new water supply infrastructure in response to growth as it occurs in the county, which is generally guided by the various general plans. Secondary environmental impacts from future CCWD projects, therefore, are assumed to be similar to those of the Contra Costa County and city general plans.

Delta Expressway

In response to traffic problems in eastern Contra Costa and Alameda Counties, a joint planning effort between Contra Costa County, Alameda County, CCWD, Antioch, Brentwood, and Livermore defined a corridor, referred to as the east county corridor, for transportation facilities between Antioch and Livermore.

The State Route 4 Bypass Authority, which is comprised of the Cities of Antioch and Brentwood and Contra Costa County, has been established to identify a preferred right-of-way, preserve a precise alignment for the Delta Expressway, and evaluate information relevant to future planning for the 30-mile east county corridor. A revised NOP for this project was issued in February 1991. A draft EIR is expected to be available in 1992.

The Delta Expressway is the proposed northern portion of the 30-mile corridor in east county. It begins at the SR 4/SR 160 junction and runs south to bypass Oakley and Brentwood. South of Brentwood, the new expressway would turn east to reconnect with the existing SR 4. The Delta Expressway also would connect with the relocated Vasco Road at Walnut Boulevard.

The cost of the Delta Expressway, estimated at $150 million, is proposed to be financed with new home fees and landfill tipping fees, because state and federal funding is expected to be unavailable.

The rights-of-way for the Los Vaqueros pipeline and the Delta Expressway generally follow an existing PG&E 230-kV electric transmission line. The location of the rights-of-way is consistent with the county's general plan, which indicates that utilities should follow existing rights-of-way or approved corridors. The approximately 9-mile-long Delta Expressway right-of-way is adjacent to and parallels the Los Vaqueros pipeline for about 6.8 miles. The precise schedule for construction of the Delta Expressway is unknown but is expected to be at least several years after the Los Vaqueros pipeline would be built.

Resources along this right-of-way include agricultural lands, prime soils and soils of statewide importance, riparian woodlands that may also qualify as jurisdictional wetlands, potential habitat for special-status amphibians and reptiles, and annual grasslands. The combined direct impacts of the two projects would approximately double the acreage of resource impacts described for the Los Vaqueros pipeline. Significant cumulative direct impacts of these two projects would involve impacts on riparian woodlands (approximately 6 acres). Other direct impacts of the Los Vaqueros pipeline on resources would not contribute to cumulative impacts because the buried pipeline would cause only minor temporary impacts on those resources. Direct impacts such as air quality, noise, and construction traffic would not be cumulative impacts because they would occur at different locations and times and would not be additive.

Indirect impacts on a variety of resources could also result from implementation of the Delta Expressway project. These indirect impacts would be consistent with the Contra Costa County general plan, are described in the EIR for the general plan, and will be reevaluated in the EIR for the Delta Expressway.

Mid-State Tollway

The California Toll Road Company (CTRC) presented a proposal to Caltrans to construct the Mid-State Tollway, running from Vacaville to Sunol, which would overlap the Delta Expressway and generally follow the east county corridor. A license was granted and a franchise agreement was executed between CTRC and Caltrans.

The franchise agreement provides for CTRC to finance, construct, and operate the Mid-State Tollway, an 85-mile-long, grade-separated, multilane highway, and to earn a return on its investment by charging tolls for use of the highway.

CTRC bears the responsibility for obtaining all necessary environmental clearances and cannot begin design or construction until those clearances are received.

The project may be constructed and operated as two connected facilities. The first phase would construct a 40-mile facility from I-680 at Sunol to SR 4 near Antioch. The second phase would run from Antioch north to I-80 and I-505 near Vacaville.

At present, no alignment has been selected for the tollway. The following conceptual alignment was presented to Caltrans in late 1990. Beginning at I-680 near Sunol, the conceptual alignment would parallel SR 84 and Isabel Avenue to I-580 in Livermore and then run north and east to Vasco Road, south of the Kellogg Creek watershed. From that point, the alignment would continue north across Brushy Peak, around the eastern boundary of the Kellogg Creek watershed, and then north to SR 4 in Antioch. The tollway then would use the SR 160 right-of-way across the Antioch Bridge (a new high-span bridge across the Sacramento River is proposed) and would proceed north past Travis Air Force Base to I-80 in Vacaville. The tollway would include a connection to SR 4 just south of Brentwood.

The estimated cost for the entire tollway is $1.2 billion. The segment of the tollway in Contra Costa County is projected to cost $400 million, but CTRC proposes to provide $320 million in private funds, supplemented by $80 million in local funds.

No substantial environmental studies have been completed to date. Verification and validation of traffic generation data began in February 1991 and are expected to be completed in 1992. Following further definition of the first phase of the tollway, additional environmental studies will be undertaken, including the definition of the project and analysis of alternatives.

Relationship of the Mid-State Tollway to the Los Vaqueros Project

Funding. Early publications associated with the Mid-State Tollway proposal inaccurately identified funds that CCWD has allocated for the relocation of Vasco Road as part of the local funding that would be available for the tollway project. After these reports were published, CCWD and Contra Costa County adopted resolutions clearly indicating that the relocation of Vasco Road is entirely unrelated to the Mid-State Tollway proposal. In addition, CTRC also has subsequently provided documentation that funds related to CCWD's relocation of Vasco Road are not included in the funding proposal for the Mid-State Tollway.

Alignment. Only general descriptions of the proposed alignment are currently available. These descriptions and maps show that the proposed alignment would pass near CCWD's proposed County Line Alignment.

Road Design Standards. CCWD's proposed County Line Alignment is intended to be only a replacement roadway for the existing Vasco Road, which would be inundated if either Los Vaqueros Reservoir or Kellogg Reservoir were built. The County Line Alignment is being designed as a two-lane rural highway, using Caltrans' rolling and mountainous terrain standards. These standards allow curves with a radius as low as 800 feet and grades of up to 7%.

Although no specific standards have been identified for the tollway, most of the discussions regarding the tollway have focused on a freeway facility or limited-access expressway designed with wide curve radii (up to 3,000 feet) and grades as low as 2-3%.

The County Line Alignment as currently planned by CCWD could not feasibly be upgraded to become part of such a freeway or expressway. The required reconstruction essentially would result in an entirely new roadway, and much of the alignment would be different. Therefore, routing the tollway along the County Line Alignment would not achieve any cost savings or benefits to the tollway project proponents.

Schedule. No detailed schedule has been established for the tollway. The franchise agreement between CTRC and Caltrans requires that, to maintain the agreement, CTRC begin environmental studies within 2 years of the date of the agreement and begin construction within 10 years.

East Contra Costa County Airport

The purpose of constructing one or more new airports in Contra Costa County was originally proposed to relieve the aircraft parking and operational pressures at Buchanan Field in Concord. Site analyses were prepared in the 1970s for an airport located at Oakley and at Lone Tree Valley. Because of community opposition, the county decided to purchase and develop the already existing, privately owned Byron Airpark. Presently, the primary role of the proposed East Contra Costa County Airport at Byron Airpark is to service local users from the rapidly growing urban area in east county and projected future growth.

This project was analyzed in the East Contra Costa County Airport study, which included preparation of the Phase 1: Site Identification and Evaluation report, released in September 1984; the draft Environmental Impact Report: East Contra Costa County Airport, released in September 1985; the final EIR, released in January 1986 and certified by the county board of supervisors in May 1986; the East Contra Costa County Airport Master Plan report, released in May 1986 and adopted by the county board of supervisors in June 1986; and the Environmental Assessment for the East Contra Costa County Airport, finalized in August 1986. The project is currently in the engineering design phase; major land purchases have been made, and detailed site design is being finalized. Project construction is planned to start in 1992, with most of the earthwork being performed in summer 1992 and the paving of the runways and construction of other facilities being performed the following year (Brody pers. comm.).

The project site at Byron Airpark is located in the southeastern portion of the county, 3 miles south of Byron and 2.5 miles north of the Alameda County line. Currently 30 aircraft are based at Byron. The proposed expansion of the airpark would involve construction of a 4,350-foot-long (with potential extension to 6,000 feet) primary instrument runway, oriented from northwest to southeast. A nonprecision approach runway would be oriented west/southwest-north/northeast, would be 3,750 feet long and lighted for nighttime use. Both runways would have full-length parallel taxiways. The expanded airpark could accommodate 540 based aircraft, with apron area available for up to 60 transient aircraft. The project would widen and improve both Armstrong and Byron Hot Springs roads for airport access, and would relocate

2,800 feet of the irrigation canal as it crosses Byron Hot Springs Road. Projected costs for the airpark expansion (in 1985 dollars) are $7.2 million for initial development and $12.5 million for full development.

The EIR for the proposed project identified that expansion of the airpark would eliminate approximately 35 acres of vernal pool habitat, conflict with the operation of wind turbine farms erected along the Altamont Pass and proposed within 1 mile of the airport, potentially affect local water supply and wastewater disposal systems, and potentially induce growth in the surrounding area.

CUMULATIVE IMPACTS

Affected Environment

The following sections summarize the physical and socioeconomic conditions within the cumulative impacts analysis study area (east county), and are based on the Contra Costa County general plan (Contra Costa County Community Development Department 1991).

Physical Setting

The county stretches approximately 40 miles from west to east and approximately 20 miles from north to south, encompassing approximately 732 square miles (468,500 acres). The county can be separated into three areas: west county, central county, and east county. The eastern part of Contra Costa County boarders San Joaquin, Sacramento, and Solano Counties.

Contra Costa County contains a diverse social and physical environment. In contrast to the western and central portions of Contra Costa County, which consist of urban and suburban environments, the eastern part of the county has predominantly agricultural communities.

The east county area is the largest land area in the county and includes much of the hilly terrain of the Diablo Range. This area is more sparsely populated than other areas of the county and contains more open space lands, including the Kellogg Creek watershed. Cities located in the east county area include Pittsburg, Antioch, and Brentwood, as well as the unincorporated areas of West Pittsburg, Oakley, Bethel Island, Knightsen, Byron, and Discovery Bay.

Socioeconomic Setting

Contra Costa County's population steadily increased from 1980 to 1990, growing from approximately 656,400 to 802,933 residents (Contra Costa County Community Development Department 1991). Population growth spurred a 25% increase in housing during the 1980s, with an average of nearly 6,300 homes built annually over the 10-year period.

Much of the new housing growth has occurred in the northern portion of the central county area, especially in the communities between Walnut Creek and Martinez along the north I-680 corridor. Approximately 19,600 housing units were built in this area during the 1980s, representing a 17% increase. Housing development in the east county area has been even more rapid. Since 1980, the east county area has added approximately 19,700 housing units, representing a 48% increase over its 1980 housing stock.

Employment in the county has grown by approximately 45% since 1980, increasing from 201,200 to 292,700 jobs. Much of this growth has occurred in the services, retail trade, and transportation/

communication/utilities sectors. Together, these three employment sectors added approximately 59,900 new jobs, or 65% of all new jobs generated by growth in the county, between 1980 and 1990.

Environmental Consequences

Existing Conditions

Under existing conditions, existing water demands (1989) in the regional study area are assumed to continue in the future. This scenario is unlikely because CCWD has both supply and delivery capabilities to provide more than the 119,572 af of water sold in 1989. Assuming the Contra Costa Canal can be operated at maximum design efficiency, some expansion of CCWD's water service can be accommodated without expanding the system's delivery capability.

If CCWD's water supply were limited to the amount delivered in 1989, growth in the study area would be severely curtailed. Indirect impacts of this limitation would include reduced demand for the expansion of infrastructure such as streets and highways, schools, water and wastewater treatment facilities, solid waste disposal facilities, public safety facilities, and mass transit. Secondary environmental impacts resulting from expected future growth in the study area would be decreased, including the loss of wildlife habitat and special-status plant species, air quality degradation, and the loss of agricultural land. Adverse socioeconomic effects of reduced growth would include substantially reduced new employment opportunities and reduced income growth within the county.

No-Action Alternative

The No-Action Alternative assumes that the Contra Costa Canal will be expanded as necessary to continue to meet the demand for water in the study area. The lack of canal capacity in certain portions of the canal could be a constraint to water delivery and, thereby, growth within the study area. As discussed above under "Other CCWD Planned Water System Improvements", the canal would be expanded in response to planned growth.

Development according to the Contra Costa County general plan would result in a projected population of approximately 452,000 in the study area by 2005. Because Contra Costa County is the regional agency with primary planning responsibilities in the study area, growth is likely to occur at rates similar to those detailed in the general plan. The secondary growth-related impacts of the No-Action Alternative are therefore based on impacts identified in the EIR for the Contra Costa County general plan (Contra Costa County Community Development Department 1991).

The analysis of impacts presented in the EIR for the Contra Costa County general plan is incorporated into this document by reference. Mitigation measures adopted by the county to avoid or reduce impacts of the general plan, would be required to reduce cumulative impacts of this and other alternatives identified in this chapter. Numerous mitigation measures were adopted by Contra Costa County as part of the general plan. A list of the types of measures included as part of the plan includes:

- Policy-type measures to protect sensitive natural and cultural resources requires the county to ensure that urban development takes place such that agricultural lands, wetlands, archeological resources, historical resources, and scenic resources are protected. In particular, policies state that no ground-disturbing activities should take place within 100 feet of prime agricultural lands or wetlands.

- Specific mitigation measures include restoring vegetation and refining and redesigning portions of projects to avoid sensitive resources.

- Measures to plan for and manage growth in a controlled fashion include planning concepts such as implementing jobs/housing balance and infill policies and establishing an urban limit line.

- Measures to accommodate planned growth include providing infrastructure such as transportation facilities, water supply and treatment facilities, flood control projects, waste disposal facilities, and other public utilities and services.

Los Vaqueros Reservoir Alternative

Agricultural Resources. The Los Vaqueros Reservoir Alternative would result in the permanent conversion of a small amount of prime farmland and approximately 1,600 acres of nonprime agricultural lands to nonagricultural uses. Although the impact on prime farmland would be less than significant on a project-specific basis, construction of the Los Vaqueros Reservoir Alternative, other CCWD improvements, the Delta Expressway, the Mid-State Tollway, and the airport, along with buildout of the general plan, would result in a significant loss of prime agricultural lands in east county. The planned development of 8,185 housing units in the eastern part of the county alone would affect 3,520 acres of prime farmland. The county determined that the loss of approximately 6,500 acres of prime (Class I and II) lands could occur. CCWD would contribute a minor amount (10-20 acres) to this significant cumulative impact, which cannot be reduced to a less-than-significant level.

The cumulative loss of nonprime agricultural lands in east county also would be significant. Implementation of mitigation measures adopted by the county for the portion of east county under its jurisdiction would reduce these cumulative impacts to less-than-significant levels if applied by all planning agencies within the county.

Transportation and Circulation. Contra Costa County found that traffic service levels throughout the county will generally deteriorate beyond acceptable levels. This alternative would contribute to the cumulative addition of traffic to a circulation system already projected to be congested. Development of recreation facilities within the Kellogg Creek watershed could induce additional vehicle trips within the county. The more intense land development proposed in the general plan, along with the growth that would be allowed by the further expansion of CCWD facilities, would also generate more traffic in this region. Furthermore, the proposed Delta Expressway and Mid-State Tollway projects would likely attract more traffic into east county by providing new capacity and inducing more growth. This impact would be unavoidable. CCWD could partially reduce its contribution to this impact by implementing the mitigation measures described in Chapter 13, "Transportation".

Public Facilities. Although growth itself would be neither adverse nor beneficial, the secondary impacts of growth, including increased demand for water supply and treatment and public utilities and services, could be substantial. The cumulative growth-related secondary effects of the Los Vaqueros Reservoir project, in combination with buildout of the Contra Costa County general plan and other related projects, would likely increase demand for public services and utilities. However, because this growth has been planned for, this impact would be less than significant.

Vegetation Resources. The Los Vaqueros Reservoir Alternative would contribute to the cumulative loss of resources in two common natural vegetation communities, blue oak woodland and mixed north slope woodland, and three sensitive natural communities, mature valley oak woodland, willow cottonwood riparian woodland, and alkali wetland. Acquisition and management of Kellogg Creek watershed lands will provide substantial preservation of these resources. Contra Costa County has adopted numerous policies that protect sensitive biological sites and require appropriate mitigation for impacts on these sites. The preservation of sensitive biological resources in the watershed to be purchased by CCWD, combined with the implementation of the mitigation measures recommended in Chapter 7, "Vegetation Resources", would reduce these impacts to a less-than-significant level.

Implementation of the Los Vaqueros Reservoir Alternative would contribute to the cumulative loss of blue oak and mixed north slope oak woodlands occurring in east county. Although the oak woodlands that would be directly affected by the project comprise only 1% of the project area blue and mixed north slope oak woodlands, any proposed foothill development in the county would also likely affect these resources and the impact would be significant on a cumulative basis.

This alternative would also contribute to the cumulative loss of valley oak woodland. About 180 acres of valley oak woodland would be lost in the inundation area of the reservoir. Valley oaks are rare in Contra Costa County, and, unlike blue oaks, occur in flatter valley areas, which are prime areas designated for development in the county general plan. This cumulative loss of valley oak woodland would be a significant impact to which the Los Vaqueros Reservoir Alternative would contribute.

The county staff has previously considered an ordinance to protect heritage and native oak trees; however, such an ordinance has not been adopted. To mitigate the loss of oak woodland communities on a countywide basis, Contra Costa County should finalize and adopt a heritage tree ordinance to protect remaining oak woodlands. In addition, implementation of the mitigation measures described in Chapter 7, "Vegetation Resources", on a countywide basis to avoid or compensate for the loss of oak trees would reduce this impact to a less-than-significant level.

This alternative would affect about 3 acres of willow cottonwood riparian woodland, which occurs along creeks and other major drainages. Willow-cottonwood riparian woodland qualifies as jurisdictional wetlands. The amount of this type of community has diminished considerably because of development in the county; therefore, any further losses contribute to the significant cumulative loss of this resource occurring in east county.

To mitigate the loss of willow-cottonwood riparian woodland in east county, CCWD should implement the mitigation measures recommended in Chapter 7, "Vegetation Resources", and preserve riparian woodlands within the Kellogg Creek watershed.

The Los Vaqueros Reservoir Alternative would also contribute to the cumulative loss of rare seasonal alkali wetland communities. The East Contra Costa County Airport project, the Delta Expressway, the Mid-State Tollway, and development planned for east county in the general plan are all proposed projects that would be constructed in areas where seasonal alkali wetland resources occur. This alternative would affect from 1 to 50 acres of the alkali wetlands in the eastern part of the county. This cumulative impact would be significant. To reduce this impact to a less-than-significant level, CCWD should implement mitigation measures recommended in Chapter 7, "Vegetation Resources", to avoid or compensate for the loss of alkali wetlands and preserve any alkali wetlands within the area of the watershed to be purchased by CCWD.

Wildlife Resources. The Los Vaqueros Reservoir Alternative would result in the loss of about 900 acres of grasslands, an important wildlife habitat for six special-status wildlife species, including the kit fox, golden eagle, burrowing owl, tiger salamander, red-legged frog, and western pond turtle.

Annual grasslands are diminishing in east county because of development, and development from buildout of the general plan, the East Contra Costa County Airport, the Mid-State Tollway, and the Delta Expressway projects would result in further losses of annual grasslands. Therefore, this impact would be significant on a cumulative basis.

The Los Vaqueros Reservoir Alternative, in combination with the East Contra Costa County Airport project, the Mid-State Tollway project, and other development proposed in the county general plan, would result in cumulative impacts on one endangered species, the San Joaquin kit fox, and two wildlife species of special concern, the golden eagle and burrowing owl. In addition, this alternative, in combination with the proposed Delta Expressway project, would result in cumulative impacts on three species of special concern: the California tiger salamander, California red-legged frog, and burrowing owl. This impact would be significant.

Acquisition and management of Kellogg Creek watershed lands will provide substantial preservation of these resources. Contra Costa County has adopted numerous policies that protect sensitive biological sites and require appropriate mitigation for impacts on these sites. The preservation of sensitive biological resources on watershed lands to be purchased by CCWD, combined with the implementation of the mitigation measures recommended in Chapter 7, "Vegetation Resources", and Chapter 8, "Wildlife Resources", would reduce these impacts to less-than-significant levels.

Cultural Resources. The Los Vaqueros Reservoir Alternative would contribute to the cumulative loss of cultural (archeological and historical) resources in east county. Acquisition and management of Kellogg Creek watershed lands will provide considerable preservation of these resources. Numerous extremely sensitive and highly sensitive archeological areas are located in east county. The county has adopted policies that protect sensitive cultural resource sites, and the southeast county area has been planned mostly for agriculture, watershed, or public purposes. However, certain areas within the southeastern part of the county have been slated for development. The proposed Delta Expressway, Mid-State Tollway, East Contra Costa County Airport, and urban development designated in the general plan would take place in areas rich with significant archeological finds. The preservation of sensitive cultural resources on watershed lands to be purchased by CCWD, combined with the implementation of the mitigation measures recommended in Chapter 11, "Cultural Resources", and those adopted as part of the Contra Costa County general plan, would reduce these impacts to less-than-significant levels.

Kellogg Reservoir Alternative

The Kellogg Reservoir Alternative would contribute to cumulative impacts on agricultural resources, transportation and circulation, public facilities, wildlife resources, and cultural resources that would be essentially identical to those described above for the Los Vaqueros Reservoir Alternative.

Vegetation Resources. The Kellogg Reservoir Alternative would contribute to the same cumulative impacts on vegetation resources as would the Los Vaqueros Reservoir Alternative, with one additional cumulative impact on three special-status plant species. Brittlescale and San Joaquin spearscale, which occur in alkali wetlands, are both candidate species for federal listing. Stinkbells, a species of limited distribution, occurs in heavy clay soils of valley bottoms and canyon slopes of grasslands and oak woodlands. Any further loss of alkali wetland, grassland, or oak woodland communities would potentially contribute to the cumulative loss of these special-status plant species. Cumulative impacts and mitigation for loss of these natural communities are described above for the Los Vaqueros Reservoir Alternative.

Desalination/EBMUD Emergency Supply Alternative

Agricultural Resources. This alternative would contribute to cumulative impacts on agricultural and cultural resources similar to those described above for the Los Vaqueros Reservoir Alternative.

Wildlife Resources. The loss of annual grassland wildlife habitat under this alternative would not be significant, even on a cumulative basis, because the small amount of grassland affected by this alternative is not considered to have important wildlife habitat value.

The Desalination/EBMUD Emergency Supply Alternative, in combination with the planned improvements to the CCWD water system and other development proposed in the county general plan, could result in cumulative impacts on one endangered species, the saltmarsh harvest mouse, and three other special-status wildlife species that are candidates for federal listing, the Suisun song sparrow, saltmarsh yellow throat, and California black rail. These species rely on the brackish march habitat in the northeastern part of the county. Although the exact locations of CCWD system improvements are unknown at this time, this impact would be significant if any construction activities take place that would affect brackish marsh in the Delta.

Contra Costa County has adopted numerous policies that protect sensitive biological resources. To the extent possible, projects should be designed to not affect this habitat. The avoidance and preservation of sensitive biological resources in the Delta, in combination with the implementation of the mitigation measures recommended in Chapter 7, "Vegetation Resources", and Chapter 8, "Wildlife Resources", would reduce these impacts to less-than-significant levels.

Middle River Intake/EBMUD Emergency Supply Alternative

This alternative would contribute to cumulative impacts on agricultural and cultural resources similar to those described above for the Los Vaqueros Reservoir Alternative.

Vegetation Resources. The Middle River Intake/EBMUD Emergency Supply Alternative would also contribute to the cumulative loss of rare alkali wetland communities. The East Contra Costa County Airport project, Delta Expressway, Mid-State Tollway, and development planned for east county in the general plan are all proposed projects that would be constructed in areas where alkali wetland resources occur. Although this alternative would affect only about 1 acre of alkali wetlands, this impact would be significant on a cumulative basis because of the biological importance and diminishing nature of this resource in east county. To reduce this impact to a less-than-significant level, CCWD should implement mitigation measures recommended in Chapter 7, "Vegetation Resources", to avoid or compensate for the loss of alkali wetlands, and preserve any alkali wetlands within the area of the watershed to be purchased by CCWD.

Wildlife Resources. The loss of annual grassland wildlife habitat under the Middle River Intake/EBMUD Emergency Supply Alternative would not be significant, even on a cumulative basis, because the small amount of grassland affected by this alternative is not considered to be of important wildlife habitat value.

ANALYSIS OF GROWTH-RELATED EFFECTS

Purpose

The project alternatives addressed in this EIR/EIS were designed to improve the quality of water supplied to CCWD customers, minimize seasonal quality changes, and improve the reliability of the water supply; however, the project alternatives, together with other nonproject system improvements planned by CCWD, could remove some water system capacity constraints within CCWD. This section describes the relationship of the project alternatives to other related projects in the vicinity and evaluates the consistency of the alternatives with plans for growth in the region.

Additionally, recent changes in land use plans have led to small changes in the assumptions underlying the water demand analysis prepared for sizing project facilities. These changes also have implications for portions of the analysis presented elsewhere in this report. The sensitivity of the analyses to these recent land use changes is evaluated in this chapter.

Approach

The State CEQA Guidelines (Section 15358) state that analysis of environmental effects should include indirect or secondary effects caused by the project that are reasonably foreseeable, including growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate and related effects on air, water, and other natural systems, including ecosystems.

Although this project does not appear to induce changes in population density or growth rates, the physical facilities will induce changes to the environment.

The State CEQA Guidelines (Section 15126[g]) define growth inducement to include those projects that would remove obstacles to population growth, such as a major expansion of a wastewater treatment plant that would allow more development in the plant's service area.

NEPA regulations define "effects" to include both "direct effects", those that are caused by the action and occur at the same time and place, and "indirect effects", those that are caused by the action and occur later or farther away but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects of induced changes in land use patterns.

Although implementation of any alternative alone would not induce substantial growth in the region, the cumulative impacts of the project alternatives, in combination with nonproject system improvements, could potentially be considered growth inducing in two ways. First, the elimination of constraints in CCWD's water conveyance system could support additional residential, commercial, and industrial development within CCWD's planning area. Second, a reservoir in east county could attract new residents and businesses to the vicinity of the reservoir, resulting in additional local growth.

Regional growth potentially induced by the project alternatives, in combination with other nonproject water system improvements, was evaluated by determining the future water demands planned for by CCWD. These demands were then compared to demands resulting from growth projected to occur within the study area under buildout of the Contra Costa County general plan. The consistency of these projections was then evaluated, with emphasis given to differences and inconsistencies. The analysis contained in the Contra Costa County general plan EIR was then referred to, as provided for in the State CEQA Guidelines, as the basis for identifying regional growth impacts that would occur under the project alternatives.

The effects of growth potentially induced in the local area by reservoir construction were evaluated by assessing the level of growth that could be induced by project construction and operation. Chapter 12, "Human Environment", analyzes the effects of construction of the project alternatives and localized growth patterns. Because only the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives have the potential to attract additional growth through the creation of a large open space area and reservoir, the local growth-inducing analysis in this chapter focuses on these alternatives.

Relationship of Water System Improvements to Planned Growth

The availability of water is one factor that influences the magnitude and location of population growth in an area. While the availability of water and water-related facilities may permit growth within a specific area, it does not cause growth. For this analysis, the alternatives are considered to be growth inducing when they would, in connection with planned, nonproject system improvements, supply water within the study area in quantities greater than under existing conditions (1989 Contra Costa Canal demands).

Under its water contract with Reclamation, CCWD is allowed to divert up to 195,000 af/yr of water from Rock Slough. Because of physical constraints in CCWD's delivery system, however, only about 135,000 af/yr can be delivered at this time based on historical diversion patterns. Currently, CCWD uses approximately 120,000 af/yr.

Modification of the Contra Costa Canal and pumping plants would be required to deliver the amount of water allowed under the Reclamation contract and to meet projected demands for water in the CCWD planning area. These improvements would occur with or without the project; even with implementation of the alternatives considered in this EIR/EIS, CCWD's ability to deliver water to its service area would be

constrained by the inadequate canal capacity. No specific designs or plans exist for these canal and pumping plant improvements. Canal improvements would accommodate growth planned for by planning agencies within the CCWD service area rather than encourage growth above planned levels.

Water Demand Analysis Projections

The project alternatives were sized based on CCWD estimates of future water demand within the planning area described in Chapter 1. Several water demand scenarios were evaluated as part of CCWD's planning effort (refer to Chapter 1, "Purpose of and Need for the Los Vaqueros Project").

Planning area boundaries, land use information, and conservation and system loss estimates were used for calculating the future CCWD water demands. Water demands for all areas within the planning area were based on land use designations in current city general plans and the draft Contra Costa County general plan. The planned land uses were inventoried based on approved general plan land use maps for each city and the draft general plan land use map for Contra Costa County as of September 1989.

Average water use estimates for each land use were then applied to the general plan land use inventories to estimate water demands upon buildout of each jurisdictions planning area, as discussed in Chapter 1, "Purpose of and Need for the Los Vaqeros Project". Using this methodology instead of the more traditional population-based methodology, CCWD has developed demand estimates that reflect the growth (e.g., residential, commercial, and industrial) planned for by each jurisdiction and analyzed in the respective agencies' general plan EIRs. Thus, CCWD would not be encouraging growth, nor is it sizing facilities based on demands in excess of what is planned for by the planning agencies; it would be responding to projected and planned growth.

Two differences exist between CCWD's demands and the county general plan. Since the development of the demands, the county general plan was revised and adopted, thus resulting in land use changes that differ slightly from those used by CCWD. These differences are discussed below. The other difference is that the county used 2005 for analysis purposes. CCWD used 2025. This year was estimated based on historical growth and projected trends for each municipal raw water customer. The growth rates were based on preliminary ABAG data to 2005 and then adjusted beyond that date depending on apparent developable land within the SOIs. The rates were then confirmed by the county (Parfrey 1989), based on its preliminary analysis of ABAG data. Per capita consumption figures from each water supplier were applied to the projections. This analysis, combined with the land use demand analysis, provides a rough idea of when buildout demands may be realized. The date of buildout demands is approximate.

Because of the timing in planning the Los Vaqueros Project, water demands were not based on the adopted Contra Costa County general plan, but were based on land uses contained in the September 1989 draft of the general plan. Land uses contained in this draft were slightly modified before the plan was adopted. The modifications were relatively minor, but several areas were affected by the following modifications:

- The land use designation on several parcels in the planning area changed. Most significantly, the designation for an area at the northeast corner of the Oakley planning area changed from agricultural to M-8. The M-8 designation allows for urban development that is disallowed by the agricultural designation. This change would result in a water demand increase of 2,700 af/yr beyond the demands described in Chapter 1 "Purpose of and Need for the Los Vaqueros Project".

- Several properties have been annexed into CCWD's SOI and service area. The increased water demand resulting from these annexations would be minor.

Because of the level of detail needed for facility design, the water demand assumptions will likely be modified slightly as the project proceeds. CCWD recognizes that minor changes to the assumptions have occurred and will continue to occur before the project is completed.

Environmental Consequences

Criteria for Conclusions of Significance

Regional Effects. Constraints in water availability or infrastructure to treat and distribute water may be considered obstacles to planned growth. Actions that increase water availability in an area or that remove infrastructure constraints may allow more development in a service area.

According to Appendix G of the State CEQA Guidelines, a project will normally have a significant effect on the environment if it will induce substantial growth or concentration of population. Substantial growth in any area may result in unplanned development and strain to public services. Substantial growth also may result in impacts on biological resources and air quality. The growth-inducing effects of the project alternatives are considered significant if substantial population growth would occur and if the induced growth would result in adverse environmental effects.

Local Effects. As described above, a project normally will have a significant effect on the environment if it will induce substantial growth or concentration of population. The local growth-inducing effects of the project alternatives are considered significant if substantial growth would occur as a result of the construction and operation of the alternatives' components.

Existing Conditions

Under existing conditions, existing water demand conditions (1989) in the regional study area are assumed to continue into the future. This scenario is unlikely because CCWD has both supply and delivery capabilities to provide more than the 119,572 af of water sold in 1989. Assuming the Contra Costa Canal can be operated at maximum design efficiency, some expansion of CCWD's water service can be accommodated without expanding the system's delivery capability.

If CCWD's water supply were limited to the amount delivered in 1989, growth in the study area would be severely curtailed. Indirect impacts of this limitation would include reduced demand for the expansion of infrastructures, such as streets and highways, schools, water and wastewater treatment facilities, solid waste disposal facilities, public safety facilities, and mass transit. Secondary environmental impacts resulting from expected future growth in the study area would decrease, including the loss of wildlife habitat and special-status plant species, air quality degradation, and the loss of agricultural land. Adverse socioeconomic effects of reduced growth would include substantially reduced new employment opportunities and reduced income growth within the county.

No-Action Alternative

The No-Action Alternative assumes that the Contra Costa Canal will be expanded as necessary to continue to meet the demand for water in the study area. The lack of capacity in portions of the canal could constrain water delivery and, thereby, growth within the study area. As discussed above under "Relationship of Water System Improvements to Growth", the canal would be expanded in response to planned growth.

Development according to the Contra Costa County general plan would result in a population of approximately 452,000 in the study area by 2005. Because Contra Costa County is the regional agency with

primary planning responsibilities in the study area, growth is likely to occur at rates similar to those detailed in the general plan. The growth-inducing impacts of the No-Action Alternative are therefore based on impacts identified in the Contra Costa County general plan EIR (Contra Costa County Community Development Department 1991).

An analysis of the impacts of planned growth in the county is presented in the Contra Costa County general plan EIR. The EIR also presents mitigation measures adopted by Contra Costa County. Because a general plan is a programmatic document, impacts are characterized countywide but are generally applicable to the study area.

Because a reservoir would not be constructed in the Kellogg Creek watershed under the No-Action Alternative, local growth-inducing effects resulting from reservoir construction and operation would not result from implementing this alternative.

Los Vaqueros Reservoir Alternative

Regional Growth Effects. The Los Vaqueros Reservoir would be sized and constructed to meet demands associated with the planned land uses identified by the local jurisdictions. Delivery of over 135,000 af/yr of water to customers in the study area could not be accomplished without major improvements to the water delivery system. As discussed previously, system improvements would be made in response to current and planned future growth. Because growth in the study area is primarily controlled by Contra Costa County and cities in the study area, growth would be controlled by agencies other than CCWD. Contra Costa Canal improvements and water deliveries, therefore, would correlate with growth rates and levels of service planned for and allowed by various city and county planning agencies. The regional impacts of growth under the Los Vaqueros Reservoir Alternative therefore would be similar to impacts under the No-Action Alternative.

Local Growth Effects. A reservoir and large open space area containing significant recreational opportunities within the Kellogg Creek watershed could influence new development. The likelihood of a substantial amount of development being induced by the Los Vaqueros Reservoir Alternative is limited for the following reasons:

- CCWD is purchasing the entire watershed area and no substantial new development would be allowed within the watershed, the viewshed of the reservoir, or 3-4 miles around the reservoir.

- General plan and zoning designations near the Kellogg Creek watershed in both Contra Costa and Alameda Counties are generally for large-parcel (5-acre minimum) agriculture.

- Some development is already occurring in the general vicinity of the Kellogg Creek watershed that would be unaffected by the implementation of this alternative.

- Recreation activities proposed for this alternative are passive and would not support intensive use.

- Construction and operation of this alternative could induce a small amount of growth in the vicinity of the watershed if employees were to locate near the reservoir site. These effects would be minor (refer to Chapter 12, "Human Environment").

Local growth-inducing and cumulative growth-related impacts of the Los Vaqueros Reservoir Alternative would, therefore, be less than significant.

Kellogg Reservoir Alternative

Growth would be accommodated within the region and within the project vicinity of the Kellogg Reservoir Alternative, resulting in growth rates and impacts similar to the Los Vaqueros Reservoir Alternative and No-Action Alternative.

Desalination/EBMUD Emergency Supply Alternative

Regional Growth Effects. Implementation of this alternative would ultimately result in water deliveries similar to those under the Los Vaqueros Reservoir Alternative; however, these deliveries would be constrained in the short term by the lack of capacity of the Contra Costa Canal. Canal improvements would likely occur as previously described. Growth accommodated by this alternative, in combination with the canal improvements, would be similar to growth anticipated under the No-Action Alternative.

Local Growth Effects. A reservoir would not be constructed and operated in the Kellogg Creek watershed under this alternative, which would avoid any growth-inducing effects in the vicinity of the watershed. Construction and operation of a desalination plant could induce a small amount of growth in the vicinity of the plant as employees locate near the plant site. These effects would be minor. (Refer to Chapter 12, "Human Environment").

Middle River Intake/EBMUD Emergency Supply Alternative

Implementation of the Middle River Intake/EBMUD Emergency Supply Alternative would result in regional and local growth impacts similar to these under the Desalination/EBMUD Emergency Supply Alternative, and water deliveries similar to those under the Los Vaqueros Reservoir Alternative.

Effects of Minor Changes in Water Demands on Environmental Impact Analyses

As described above under "Water Demand Analysis Projections", minor changes in the Contra Costa County general plan have occurred since CCWD initially used the draft general plan to develop its water demand projections. In addition, CCWD also has annexed several small properties into its service area, resulting in an increased demand for water.

The total increase in demands projected for these additional uses is about 3,000-4,000 af/yr. This increase is approximately 2% of CCWD's projected annual water demands and would involve diverting approximately an additional 500 af during peak months (July-August). This increase in demands also would result in slight increases in diversions from the Delta. A sensitivity analysis conducted to determine the potential effect of this increase in demands on Delta hydrology, water quality, and fisheries indicates that no new significant impacts would result and that the magnitude of significant impacts already described for each resource would increase only slightly. The mitigation measures described in each chapter of this Stage 2 EIR/EIS would continue to be appropriate and would mitigate the effects of CCWD diversions, including the increased diversions, to less-than-significant levels.

Chapter 19. Impact Conclusions and Environmental Commitments

SIGNIFICANT AND UNAVOIDABLE IMPACTS

Significant and unavoidable environmental impacts associated with each project alternative are listed below. Unavoidable impacts are those impacts that would occur even when the mitigation measures incorporated into the project description and the mitigation measures described in each resource chapter are implemented.

Los Vaqueros Reservoir Alternative

Significant and unavoidable impacts under this alternative are listed below:

- Visually disruptive influence of the new electric transmission line associated with the new supplemental intake facilities, and effects of the exposed unvegetated ring around the reservoir when it is drawn down, particularly during drier years. No mitigation is available to substantially reduce these impacts.

- Irretrievable commitment of 12 acres of soils designated as prime, unique, or of statewide importance at the various intake facility sites, and commitment of 10 acres of such soils at the Kellogg transfer reservoir site (Rock Slough/Old River No. 1 and Rock Slough/Clifton Court Forebay configurations only). No mitigation is available to substantially reduce these impacts.

- Low-to-moderate probability of RIS resulting from reservoir operations. The most likely form of RIS activity would be small, unnoticeable events. The possibility of larger magnitude RIS cannot be eliminated, however. CCWD will monitor seismic activity at the reservoir site. Should increased seismic activity be detected, a reservoir operations plan will be developed and implemented.

- Relocation of residents from five residences within the reservoir inundation zone and one additional residence along the Old River No. 2, No. 3, and No. 4 pipeline alignments. Although these impacts cannot be reduced to less-than-significant levels, CCWD will fully compensate property owners and will provide relocation assistance pursuant to state laws and CCWD policy.

- Potential loss of access to a portion of the domengine sandstone formation along the Old River No. 1 pipeline alignment. No mitigation is available to substantially reduce this impact.

- Increased fugitive dust and ozone precursor emissions during construction, and increased ozone precursor emissions and nitrogen oxides from future recreation-related traffic. Although these impacts cannot be reduced to less-than-significant levels, CCWD will employ appropriate dust reduction measures and will encourage the extension of public transit to the watershed and investigate the use of low-emission vehicles for the shuttle proposed as part of the recreation plan.

Kellogg Reservoir Alternative

Significant and unavoidable impacts under this alternative are listed below:

- Visually disruptive influence of the new electric transmission line associated with the new supplemental intake facility, and effects of the exposed unvegetated ring around the reservoir when it is drawn down, particularly during drier years. No mitigation is available to substantially reduce this impact.

- Low-to-moderate probability of RIS resulting from reservoir operations. The most likely form of RIS activity would be small, unnoticeable events. The possibility of larger magnitude RIS cannot be eliminated, however. CCWD will monitor seismic activity at the reservoir site. Should increased seismic activity be detected, a reservoir operations plan will be developed and implemented.

- Irretrievable commitment of 12 acres of soils designated as prime, unique, or of statewide importance at the intake facility site. No mitigation is available to substantially reduce this impact.

- Relocation of residents from two residences within the reservoir inundation zone. Although these impacts cannot be reduced to less-than-significant levels, CCWD will fully compensate property owners and will provide relocation assistance pursuant to state laws and CCWD policy.

- Increased fugitive dust and ozone precursor emissions during construction, and increased ozone precursor emissions and nitrogen oxides from future recreation-related traffic. Although these impacts cannot be reduced to less-than-significant levels, CCWD will employ appropriate dust reduction measures and will encourage the extension of public transit to the watershed and investigate the use of low-emission vehicles for the shuttle proposed as part of the recreation plan.

Desalination/EBMUD Emergency Supply Alternative

Significant and unavoidable impacts under this alternative are listed below:

- Visually disruptive influence of new electric transmission lines associated with the desalination plant. No mitigation is available to substantially reduce this impact.

- Irretrievable commitment of 99 acres of soils designated as prime soils. No mitigation is available to substantially reduce this impact.

- Relocation of residents from one residence at the desalination plant site. Although this impact cannot be reduced to a less-than-significant level, CCWD will fully compensate property owners and will provide relocation assistance pursuant to state laws and CCWD policy.

Middle River Intake/EBMUD Emergency Supply Alternative

Significant and unavoidable impacts under this alternative are listed below:

- Visually disruptive influence of new electric transmission lines associated with the new supplemental intake facility. No mitigation is available to substantially reduce this impact.

- Irretrievable commitment of 12 acres of soils designated as being of statewide importance. No mitigation is available to substantially reduce this impact.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irreversible commitments of resources would result from implementing any of the project alternatives. These resources include:

- construction materials;
- labor;
- energy needed for construction, operation, and maintenance; and
- land conversion of agricultural, open space, and natural environments.

Land uses that would be irreversibly committed include prime agricultural lands that are used to grow row crops or that are fallow, dryland farmed grasslands, annual grasslands used for grazing, oak woodlands (under the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives), and wetland areas. The loss of wetland and oak woodland resources could be mitigated by creating new habitats as part of the project. The conversion of agricultural lands to nonagricultural uses is considered an irreversible and irretrievable commitment of resources.

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The short-term benefits of implementing any of the project alternatives include:

- improved water quality for CCWD customers and
- improved system reliability for CCWD customers.

Additionally, the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would provide the following short-term benefits:

- increased recreation opportunities,
- reduced Kellogg Creek floodflows, and
- increased reservoir fisheries habitat.

These benefits would be realized at the expense of the short-term costs listed above under "Irreversible or Irretrievable Commitments of Resources", which include:

- construction materials,
- labor, and
- energy needed for construction, operation, and maintenance.

Long-term productivity refers to values of the existing environment. The values of the existing environment that would be lost as a result of implementing any of the project alternatives would vary widely, depending on which alternative was implemented.

The Middle River Intake/EBMUD Emergency Supply Alternative would convert only a small amount of prime agricultural land to nonagricultural uses. The Desalination/EBMUD Emergency Supply Alternative would convert about 100 acres of prime agricultural land to nonagricultural uses. The Los Vaqueros

Reservoir and Kellogg Reservoir Alternatives would convert approximately 1,500-1,700 acres of dryland farmed areas and annual grasslands, 18-136 acres of wetland areas, and up to 180 acres of oak woodlands to nonagricultural uses.

The Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would also benefit long-term environmental productivity. These benefits include:

- greater flexibility in diverting water from the Delta to prevent impacts on sensitive fishery and other resources and

- public ownership and management of approximately 20,000 acres of lands that contain numerous sensitive, important, and unique natural and cultural resources, including habitat for wildlife and plant species (CCWD has already permitted the introduction of an endangered plant species, the large-flowered fiddleneck, on lands it owns in the Kellogg Creek watershed and has established policies that encourage similar actions).

ENVIRONMENTAL COMMITMENTS

This section briefly describes the mitigation measures that CCWD has preliminarily selected for implementation. CCWD would be responsible for implementing and monitoring the success of all the measures described. Only the measures that apply to the preferred alternative, the Rock Slough/Old River No. 5 configuration of the Los Vaqueros Reservoir Alternative, are included below. Also, the Mitigation Monitoring and Reporting Plan for the Vasco Road and Utility Relocation Project Environmental Impact Report, adopted by CCWD in 1990, is hereby incorporated by reference. This report identified the specific mitigation measures adopted by CCWD for the Vasco Road and utility relocation project and described responsibilities, timing, and success standards for those measures.

The Los Vaqueros Project will be designed, constructed, and operated to meet all applicable federal, state, and local laws. Numerous specific conditions to protect the environment will be included in permits obtained for the project, and CCWD will comply with all these conditions. Finally, CCWD has, throughout the development of the project, consistently designed project components that are practicable and, at the same time, the least environmentally damaging. In many cases, proposed facilities have already been relocated to avoid sensitive resources.

CCWD has preliminarily selected the following mitigation measures presented in this draft EIR/EIS to be implemented and monitored. The following sections briefly list the mitigation measures recommended to reduce the impacts of the preferred alternative.

Chapter 3, "Delta System Hydrodynamics"

No significant impacts were identified for the preferred alternative.

Chapter 4, "Delta System Fisheries"

4-1: Prevent increased levels of suspended sediments at the intake facility site.

4-2: Restore fisheries habitat at the intake facility site.

4-3: Contribute to ongoing fishery mitigation programs (mitigation for cumulative impacts).

Chapter 5, "Delta System Water Quality"

5-1: Implement soil erosion and pollutant control measures.

Chapter 6, "Kellogg Creek Water Resources and Public Safety"

6-1: Conduct studies and design the reservoir outlet structure to allow operational flexibility to manage water quality.

Chapter 7, "Vegetation Resources"

7-1: Conduct site-specific surveys and wetland delineations for any previously unsurveyed areas.

7-2: Restore sites disturbed during construction.

7-3: Avoid or minimize loss of oak woodlands during construction and final facility siting.

7-4: Protect oak woodlands from construction impacts.

7-5: Avoid or minimize loss of alkali wetlands.

7-6: Compensate for unavoidable alkali marsh losses.

7-7: Compensate for unavoidable alkali grassland and alkali meadow losses.

7-8: Compensate for unavoidable northern claypan vernal pool losses.

7-9: Prevent hydrological modification of alkali wetlands.

7-10: Compensate for willow-cottonwood, mixed, and central coast live oak riparian woodland losses.

7-12: Compensate for partial loss or fragmentation of special-status plant populations.

7-13: Prevent temporary disturbance of significant natural communities, jurisdictional wetlands, and other waters of the United States.

7-14: Prevent temporary disturbance of special-status plant populations.

7-15: Compensate for unavoidable valley oak woodland losses.

7-17: Realign Los Vaqueros pipeline.

7-18: Develop final recreation plan.

7-19: Incorporate fuel and fire management guidelines into the watershed management plan.

Chapter 8, "Wildlife Resources"

8-1: Conduct site-specific surveys for small areas not previously surveyed.

8-2: Conduct preconstruction surveys for San Joaquin kit fox and undertake appropriate precautions during construction.

8-3: Compensate for loss of San Joaquin kit fox habitat.

8-4: Install fencing and provide undercrossings along the County Line Alignment (Modified) within occupied San Joaquin kit fox habitat.

8-5: Establish temporal or physical buffer zones around active golden eagle and prairie falcon nest sites during construction.

8-6: Conduct preconstruction surveys for burrowing owls and establish appropriate buffer zones around active nests.

8-7: Maintain sufficient flows in Kellogg Creek to ensure preservation of permanent pools that are habitat for special-status reptiles and amphibians.

8-8: Prevent degradation and hydrologic modification of Brushy and Kellogg Creeks.

8-9: Relocate California red-legged frogs.

8-10: Avoid or replace California tiger salamander habitat.

8-11: Relocate western pond turtles.

8-12: Avoid rock outcrop intermittent pools.

Chapter 9, "Visual Resources"

9-1: Screen dam edges with native vegetation.

9-2: Implement a detailed quarry reclamation plan.

Chapter 10, "Geology, Seismicity, and Soils"

10-1: Monitor reservoir-induced seismicity and implement a reservoir operations management plan.

10-2: Implement a comprehensive erosion control and restoration plan.

10-3: Implement construction methods for reducing soil impacts.

Chapter 11, "Cultural Resources"

11-1: Avoid cultural resource sites.

11-2: Prevent ground-disturbing activities near sites.

11-3: Prevent access to historic properties.

11-4: Assess APE for sensitivity of buried resources and monitor areas during ground-disturbing activities.

11-5: Design project facilities to be unobtrusive.

11-6: Consult with Native American groups.

11-7: Evaluate sites and conduct data recovery for NRHP-eligible properties.

11-8: Design reuse of historic properties to preserve important characteristics.

11-9: Prepare and implement cultural resource management plan for the Kellogg Creek watershed.

Chapter 12, "Human Environment"

12-1: Coordinate siting of the Los Vaqueros pipeline with developers to minimize impacts on proposed future developments.

12-3: Construct an access road immediately west of the agricultural processing plant located near Old River, immediately south of SR 4.

Chapter 13, "Transportation"

13-7: Install a right-turn lane from southbound Vasco Road to southbound County Line Alignment (Modified), and add a left-turn lane to the County Line Alignment (Modified)/Vasco Road intersection.

13-8: Implement proper construction management techniques.

Chapter 14, "Air Quality"

14-1: Encourage extension of public transit and investigate use of low-emission shuttle.

Chapter 15, "Noise"

No significant impacts were identified for the preferred alternative.

Chapter 16, "Public Services"

16-1: Deposit wood waste at a suitable wood-waste recovery facility.

16-2: Recycle waste asphalt.

16-3: Minimize and repair damage to routes not designed for heavy truck traffic.

16-4: Construct and operate vault toilets and a collection and disposal system.

16-5: Construct and operate a wastewater treatment plant and collection system, or reserve capacity in future nearby wastewater collection and treatment facilities.

16-6: Implement water conservation measures.

16-7: Drill and operate wells and construct and operate a distribution system, or construct and operate a wastewater treatment plant and distribution system.

16-8: Construct drainage improvements.

16-9: Develop and implement a recycling program.

16-10: Negotiate a contract with Alameda County to accept solid waste, or deliver solid waste to a new Contra Costa County landfill.

16-11: Provide non-traffic-related law enforcement.

16-13: Implement fire prevention measures.

Chapter 20. Permit, Environmental Review, and Consultation Requirements

This chapter is divided into four major sections. The first section describes the major permits required to implement the proposed project. The second section is a description of the environmental review process for the Stage 2 EIR/EIS that has been undertaken to date by CCWD and Reclamation. The third section describes environmental review and consultation requirements related to NEPA and CEQA and the status of compliance with each requirement. The last section is a list of people and agencies who will receive copies of the draft EIR/EIS.

PERMITS AND APPROVALS NECESSARY TO IMPLEMENT THE PROJECT ALTERNATIVES

This EIR/EIS, which is required under CEQA and NEPA, is being prepared concurrently with environmental review and consultation required by other state and federal environmental laws and regulations under 40 CFR 1502.25.

A preliminary list of federal, state, and local permits that may be required for the proposed action and alternatives is provided in Table 20-1. Table 20-2 is a preliminary list of environmental review and consultation requirements that are being coordinated with preparation of this EIR/EIS. The permit and consultation requirements that have been identified may change during the Stage 2 EIR/EIS review process as discussions with involved agencies proceed.

ENVIRONMENTAL REVIEW

Staged Environmental Review Process

As described in Chapter 1, "Purpose of and Need for the Project", CCWD is following a staged approach to the environmental review process for the Los Vaqueros Project. Three separate environmental documents have been prepared: the Stage 1 EIR for the Los Vaqueros/Kellogg Project, certified by CCWD in 1986; the Vasco Road and Utility Relocation Project EIR, certified by CCWD in 1990; and this Stage 2 EIR/EIS. The Stage 1 EIR evaluated programmatically several potential alternatives for CCWD to meet its water quality and reliability objectives, and focused on impacts associated with acquiring and managing Kellogg Creek watershed land.

The Vasco Road and Utility Relocation Project EIR focused on the effects of relocating Vasco Road and several major utility facilities in the Kellogg Creek watershed that would be affected by construction and operation of either the Los Vaqueros or Kellogg Reservoir Alternative.

This Stage 2 EIR/EIS describes the specific impacts of all components of the Los Vaqueros Project and includes relevant information from the Vasco Road and Utility Relocation Project EIR.

Table 20-1. Permits and Approvals That May be Required for the Los Vaqueros Project Alternatives

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
Federal		
U.S. Army Corps of Engineers		
Clean Water Act Section 404 permit	The Corps issues permits for discharge of dredged or fill materials into waters of the United States; permits are issued following public interest review and analyses according to Section 404(b)(1) guidelines	Dam construction, Vasco Road relocation, and other activities requiring fill of surface waters or wetlands
River and Harbors Act of 1899 Section 10 permit	The Corps issues permits for activities in or affecting navigable waters of the United States	Construction of intake structures, fish screens, or other facilities affecting navigable Delta waters
U.S. Bureau of Reclamation		
Petition to amend water rights	Reclamation petitions SWRCB to modify rights to allow changes in diversion location, quantity, or rate	Diversion of Delta water exceeding the 350-cfs limit imposed by existing water rights
Contract amendments or approval	Reclamation amends contracts with water agencies to allow modification, construction, abandonment, or change in use of reclamation facilities, or any modification to service areas	Modification to the Contra Costa Canal and Rock Slough intake, changes in operating and maintaining the Contra Costa Canal
State		
California Department of Health Services, Sanitary Engineering Section		
Domestic water supply permit	DHS engineering section issues permits for treated water systems to allow new water appropriations, changes in the source of appropriated water, and changes in appropriation operation	Appropriation of water at new intake site and change in CCWD operations
California Public Utilities Commission (CPUC)		
Certificate of Public Convenience and Necessity	CPUC issues a certificate when utilities desire to expand their service into noncontiguous areas or when the cost of service expansion in an existing service area is high	Tie-in for project operational power, if it is determined that the certificate is required

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
California Department of Fish and Game		
Stream Alteration Agreement	DFG enters into agreements with entities proposing changes in natural conditions of rivers, streams, or lakes	Intake construction, pipeline construction, relocation of Vasco Road, and construction of Los Vaqueros or Kellogg dam and reservoir
California Department of Water Resources		
Approval to use DWR facilities	DWR evaluates and gives consent to agency plans to modify or tie into DWR facilities	Tie-in to Clifton Court Forebay, if the Rock Slough/ Clifton Court Forebay Alternative is selected
California Department of Water Resources, Division of Safety of Dams		
Approval of plans and specifications	DOSD reviews and grants approval to plans and specifications to construct or enlarge dams and reservoirs to ensure that no threat to life or property could occur because of seepage, earth movement, or other types of reservoir-induced dam failures	Designing and construction of Los Vaqueros or Kellogg dams
Notice of completion and statement of actual cost; certificate of approval to impound water	DOSD evaluates the safety of newly constructed and enlarged reservoirs and grants approval to initiate storage operations	Storage of water in a reservoir
The Reclamation Board		
Encroachment permit on project levees	The Reclamation Board reviews and grants approval to any activity affecting a Corps flood control project	Removing or depositing earth in designated Corps floodways; and installing pipelines, power lines, or intake facilities in such a way that Corps flood control projects are affected

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
State Water Resources Control Board		
Permit to appropriate water rights and/or amendment to existing water rights	SWRCB issues permit to allow the appropriation of unappropriated water from surface sources and grants approval to divert water to storage and to change purpose of use	Diversion of additional Delta supplies, change in point of diversion, storage of project water and change in water uses as municipal and industrial demands increase
Regional Water Quality Control Board		
Issuance of or waiver from discharge requirements	RWQCB may set waste discharge requirement for any proposed activity discharging waste into surface waters, projects that affect groundwater quality, and projects from which waste would be discharged in a diffused manner; waivers are also granted based on project sponsor's water quality control plans. RWQCB waste discharge requirements constitute NPDES permits where such permits are required	Any earth-moving activities, such as grading, excavating, and other construction; discharge of water from dewatering activities into storm drains and creeks; and discharge of wastewater from conveyance cleaning and desalination operations
Clean Water Act Section 401 water quality certification	SWRCB certifies that an applicant for a Section 404 and Section 10 permit complies with certain water quality standards	Any earth-moving activities, such as grading, excavating, and other construction; discharge of water from dewatering activities into storm drains and creeks; and discharge of wastewater from conveyance cleaning operations
State Lands Commission		
Land use lease for encroachment on state lands	The State Lands Commission grants a lease to use state-owned lands for purposes other than dredging; mining; or oil, gas, or geothermal exploration	Use of state-owned land for construction or siting of project facilities, if such use occurs
Dredging permit	The State Lands Commission issues a permit to parties proposing to dredge or deposit material on state-owned lands as elements of various projects	Construction of intake facilities, if state-owned lands are dredged or altered

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
California Department of Transportation		
Encroachment permit	Caltrans issues encroachment permits for projects affecting areas within the ROWs of state-owned roadways	Conveyance facility crossing the SR 4 ROW
California Division of Mines and Geology		
Surface Mining and Reclamation Act	The California Division of Mines and Geology requires an approved reclamation plan before excavation activities	Excavation of dam construction materials from watershed quarry area
San Francisco Bay Conservation and Development Commission		
Permit to construct facilities in area of commission jurisdiction	The San Francisco Bay Conservation and Development Commission issues permits for the dredging and filling of San Francisco Bay, including all lands subject to tidal action from the south end of the Bay to the Golden Gate Bridge and to the Sacramento River; the commission also issues permits for shoreline development proposed to be located within 400 feet of Bay shoreline	Construction of brine disposal pipeline and outfall facilities at Stake Point for the Desalination/EBMUD Emergency Supply Alternative
Regional and Local Agencies and Utilities		
Bay Area Air Quality Management District		
Authority to construct/permit to operate	BAAQMD issues permits based on emission estimates and subsequent tests performed at the construction facility	Use, during construction and operation of the project, of equipment or facilities that generate nitrogen oxides or particulate emissions in excess of 150 lbs/day, including all con-struction equipment, intake and transfer pumping plants, and grading activities

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
City of Brentwood Public Works Department		
Encroachment permit	The City of Brentwood Public Works Department is responsible for issuing permits for construction within city-owned ROWs	Construction of conveyance facilities within city-owned ROWs
Byron-Bethany Irrigation District (BBID)		
Encroachment permit	BBID issues permits to allow construction within or through district-owned ROWs	Construction of conveyance facilities or Vasco Road within or through BBID-owned ROWs
Byron Sanitary District		
Encroachment permit	Byron Sanitary District issues permits to allow construction of facilities that cross collection system lines	Construction of project facilities that cross district collection system lines
Contra Costa County Community Development Department		
Land use permit to establish a quarry	Contra Costa County Community Development Department issues permits for transportation of more than 1,000 cubic yards of excavated material from excavation sites	Excavation and use of material for dam construction and Vasco Road relocation, if the quarry site within the watershed is selected as part of the project
Building permit	Contra Costa County Community Development Department issues permits for all permanent structures	Construction of pump stations and recreation buildings
Contra Costa County Public Works Department		
Drainage permit	Contra Costa County Public Works Department issues permits to allow the crossing of streams or drainage facilities within the county by pipelines or roads	Construction of conveyance facilities and Vasco Road through streams or drainage facilities within Contra Costa County

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
Road encroachment permit and design approval	Contra Costa County Public Works Department issues permits and approves designs for construction within the ROWs of county-maintained roads	Construction of conveyance facilities within the ROWs of county-maintained roads
Delta Diablo Sanitation District		
Encroachment permit	Sanitation District 7A issues permits for construction of facilities that cross collection system lines	Construction of project facilities that cross collection system lines
East Bay Municipal Utility District		
Crossing permit	EBMUD issues permits to allow construction in EBMUD ROWs and crossing of EBMUD facilities	Construction of conveyance facilities that cross or connect with the Mokelumne Aqueduct
East Contra Costa Irrigation District		
Encroachment permit	ECCID issues permits to allow construction in ECCID ROWs and crossing of ECCID facilities	Construction of conveyance facilities within ECCID canal ROW
Oakley Sanitary District		
Encroachment permit	Oakley Sanitary District issues permits to allow con-struction of facilities that cross collection system lines	Construction of conveyance facilities that cross Oakley Sanitary District's collection system lines
Oakley Water District		
Encroachment permit	Oakley Water District issues permits to allow construction that crosses its facilities	Construction of conveyance facilities that cross Oakley Water District's facilities

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
<u>Reclamation districts</u>		
Access easement and permission to cross levees	Individual reclamation districts grant easements and regulate access to levees under district jurisdiction	Construction of conveyance and related facilities on reclamation district lands
<u>Atchison, Topeka, & Santa Fe Railway Company</u>		
Pipeline license	ATSF grants permission to construct facilities across ATSF ROWs	Construction of conveyance facilities across ATSF ROWs
<u>Chevron USA, Inc.</u>		
Crossing permit	Chevron grants permission to construct facilities that cross Chevron oil pipelines	Construction of conveyance facilities across pipelines and relocation of oil pipelines
<u>Pacific Bell</u>		
Access easement and/or relocation approval	Pacific Bell grants easements to allow construction across Pacific Bell facilities and grants permission to relocate Pacific Bell facilities	Construction of conveyance facilities across Pacific Bell telephone lines and relocation of lines and poles
<u>Pacific Gas and Electric Company</u>		
Consent to common use and relocation agreement	PG&E grants permission for activities undertaken within PG&E ROWs and permission to relocate PG&E facilities	Construction of conveyance alignments that cross or parallel PG&E facility ROWs and relocation of PG&E facilities
<u>Texaco Oil Company</u>		
Crossing permit and/or relocation approval	Texaco Oil Company grants approval for construction activities that cross Texaco Oil Company pipelines and grants approval to relocate facilities	Construction of conveyance facilities that cross Texaco Oil Company pipelines and relocation of Texaco facilities

Agency and Requirements	Agency Authority	Project Activities Subject to Requirements
Union Oil Company		
Crossing permit and/or relocation approval	Union Oil Company grants approval for construction activities that cross Union Oil Company pipelines and grants approval to relocate facilities	Construction of conveyance facilities that cross Union Oil Company pipelines and relocation of Union Oil Company facilities

Table 20-2. Other Environmental Review and Consultation Requirements

Agency and Requirements	Agency Authority	Project Activities Initiating Review and Consultation Requirements
Federal		
U.S. Fish and Wildlife Service		
Endangered Species Act Section 7 consultation	Federal agencies must consult with USFWS when their actions may affect listed or proposed endangered or threatened species or critical habitat	Implementation of any project alternative, because federal approval is required
Fish and Wildlife Coordination Act	Federal agencies must consult with USFWS when undertaking projects that control or modify surface water	Control and modification of surface water, because federal approval is required
National Marine Fisheries Service		
Endangered Species Act Section 7 consultation	Federal agencies must consult with NMFS when their actions may affect listed or proposed endangered or threatened anadromous or marine species or critical habitat	Implementation of any project alternative, because federal approval is required
Environmental Protection Agency		
Clean Water Act and Clean Air Act	EPA has oversight responsibility to ensure that federal and state agencies comply with the provisions of these acts	Need for permit under Section 404 of the Clean Water Act and for preparation of EIS under NEPA
State		
California Public Utilities Commission		
Notification of relocation	CPUC requires advice letter from PG&E explaining relocation intent and indicating that an EIR is being prepared	Relocation of transmission line (only if lines exceed 200 kV)

Agency and Requirements	Agency Authority	Project Activities Initiating Review and Consultation Requirements
California Department of Fish and Game		
Endangered Species Act	DFG enforces the intent of the act when state or local agency actions may affect state-listed or proposed endangered or threatened species or critical habitats	Reservoir construction, conveyance facility construction, Vasco Road relocation, and overall project operation
Fish and Wildlife Coordination Act	Federal agencies must consult with state fish and game agencies when undertaking projects that control or modify surface water	Control and modification of surface water, because federal approval is required
Office of Historic Preservation		
Archeological survey review (Archaeological Resource Protection Act, National Historic Preservation Act)	The State Historic Preservation Officer (SHPO) reviews and comments on any archeological surveys; if resources are identified, the SHPO must be consulted to determine the eligibility for nomination to the National Register of Historic Places	Archeological survey prepared
Native American Heritage Commission		
Consultation with certain Native Americans in compliance with California Public Resources Code Section 5097.98 and California Health and Safety Code Section 7050.5	The commission identifies persons who may be likely descendants of Native Americans whose remains may be found, and requires that consultation with identified persons be initiated	Plans for physical alteration of a known cultural resource site that has a likely potential for containing remains of Native Americans
Regional and Local Agencies and Utilities		
Contra Costa County Community Development Department		
Conformance with general plan	Contra Costa County Community Development Department reviews local agency projects for conformity with the general plan	Project effects on land use

Table 20-2. Continued

Agency and Requirements	Agency Authority	Project Activities Initiating Review and Consultation Requirements
Local Agency Formation Commission		
Annexation approval	LAFCO approves all annexations to local agency service districts	Annexation of land to CCWD service area
East Bay Regional Park District		
Operational agreement	EBRPD administers the maintenance and improvement of trail systems and recreational facilities in the region	Implementation of watershed recreation plan

Note: ROW = right-of-way.

Public and Agency Involvement

Public involvement in the Los Vaqueros Project has been significant since CCWD's formal commitment to the project in June 1985. Since then, CCWD and Reclamation have made substantial efforts to solicit public input to the project through the public hearings, scoping meetings, and public review periods connected with the Los Vaqueros Project Stage 1 EIR, the Vasco Road and Utility Relocation Project EIR, and the Stage 2 EIR/EIS.

Since completion of the Stage 1 EIR, CCWD has continually updated agencies, groups, and individuals that have expressed interest in the project or have jurisdiction over some aspect of the project on its progress. An ongoing series of meetings has been held with DFG and USFWS to keep these agencies abreast of the findings of biological field studies in the Kellogg Creek watershed and other areas potentially affected by the project alternatives. CCWD has continued other coordination activities, including meetings with state and local agencies regarding archeological resources in the watershed; semimonthly coordination meetings with other state and federal agencies with jurisdiction over various aspects of the project; meetings with Contra Costa and Alameda Counties; meetings with the Cities of Antioch, Brentwood, and Livermore; meetings with Caltrans, PG&E, Unocal, and Texaco representatives to discuss planning, utility, and transportation issues; and several public hearings at which the CCWD Board of Directors and the general public were informed of the status and findings of the various studies. These coordination activities have continued throughout the process of preparing the Stage 2 EIR/EIS.

CCWD and Reclamation have entered into a memorandum of understanding that clarifies the role of each agency in the environmental review process and the process to obtain and award water rights from the SWRCB.

Notice of Preparation/Notice of Intent

On March 1, 1990, an NOP/NOI was issued informing agencies and the general public that this Stage 2 EIR/EIS was being prepared and inviting specific comments on the scope and content of the document. The NOP/NOI also requested participation at the public scoping meetings. The NOP/NOI included a discussion of:

- CCWD goals and project background,
- project needs and objectives,
- the environmental review process,
- potential participation in the project,
- project configurations,
- potential alternatives to the Los Vaqueros Project,
- key environmental issues,
- consultation and coordination, and
- related activities.

Scoping Meetings

Section 15083 of the State CEQA Guidelines authorizes and encourages an early consultation or scoping process to help identify the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth in an EIR and to help resolve concerns of affected agencies and individuals. In addition, the U.S. Council on Environmental Quality EIS regulations (40 CFR Section 1501.7) require "an early and open process for determining the scope of issues to be addressed and for identifying the significant issues related to a proposed action".

CCWD and Reclamation held three scoping meetings to solicit public comments in determining the scope of the Stage 2 EIR/EIS for the Los Vaqueros Project. Scoping meetings were held in Livermore, Concord, and Antioch on April 12, 17, and 19, 1990, respectively. Before the meetings, notices were published in local newspapers announcing the time, date, location, and purpose of the meetings. Copies of the NOP/NOI and several fact sheets on the project were available at each meeting.

Each scoping meeting included an overview of the meeting's purpose, the proposed Los Vaqueros Project, the role of Reclamation in the EIR/EIS, proposed alternatives, and potentially significant environmental issues.

CCWD also filed applications for Section 404 and Section 10 permits in August 1990. The Corps issued a public notice asking for input regarding these permits in September 1990.

Scoping Report

In March 1991, CCWD and Reclamation issued the Scoping Report for the Contra Costa Water District Los Vaqueros Project Stage 2 EIR/EIS. This report presented the issues that had arisen during the scoping process and described in detail how CCWD and Reclamation would address those issues in the Stage 2 EIR/EIS. Copies of the scoping report were distributed to the public agencies, and CCWD and Reclamation have considered the comments received in response to the information presented in the report. Where appropriate, CCWD and Reclamation have modified their approaches to preparing the EIR/EIS, the alternatives analyzed, and the methodology for addressing impacts.

Summary of Public Involvement Issues

Most comments received during the scoping process for the Stage 2 EIR/EIS were from local, state, and federal agencies and from groups or corporations. Few comments were received from the general public. The comments raised key issues that would have the greatest effect on the general public, including effects of the project alternatives on existing and future recreation opportunities, effects of the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives on land uses downstream of the dams, issues relating to dam safety and siesmic events, and potential growth-inducing effects of the project alternatives. These issues are addressed throughout this Stage 2 EIR/EIS.

CONSULTATION AND COORDINATION

The status of compliance with specific environmental review and consultation requirements is described below.

Fish and Wildlife Coordination Act (16 USC 661 et seq.)

The Fish and Wildlife Coordination Act requires federal agencies to consult with USFWS and state fish and game agencies before undertaking or permitting projects that control or modify surface water. This consultation is intended to promote the conservation of wildlife resources by preventing loss of or damage to wildlife resources where possible and to provide for the development and improvement of wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to include recommendations made by USFWS and state fish and game agencies in project reports, to give full consideration to these recommendations, and to include in project plans justifiable means and measures for protecting wildlife resources.

CCWD and Reclamation have coordinated their actions extensively with USFWS and DFG throughout the preparation of the Stage 2 EIR/EIS. Both agencies responded to the NOP/NOI on preparation of the Stage 2 EIR/EIS for the Los Vaqueros Project. The comments received were given full consideration in the approach to evaluating fishery and wildlife impacts of the alternatives. USFWS and DFG were also consulted regarding the approach and methodologies used in vegetation and wildlife surveys conducted for the EIR/EIS. Mitigation measures were formulated to satisfy USFWS and DFG requirements.

CCWD has consulted with both USFWS and DFG formally and informally since 1986. Reclamation, the federal lead agency for the Stage 2 EIR/EIS, has been involved in most of these meetings since late 1990. More than 25 meetings, held primarily to address environmental issues, have been attended by both USFWS and DFG. The meetings were designed to provide a forum for discussing CCWD's study methods, results, and ensuing documentation of the biological resources potentially affected by the Los Vaqueros Project.

To gather information on plant and animal species in the Kellogg Creek watershed, this area was the subject of several years of study, culminating in a report submitted in February 1989 to both USFWS and DFG, Results of Biological Resource Inventories and Habitat Evaluations in the Kellogg Creek Watershed (Jones & Stokes Associates 1989b). These were supplemented with additional studies in 1989 and 1990, and in January 1991 a second report was submitted to USFWS and DFG, Results of Supplemental Biological Inventories Conducted for the Los Vaqueros Project in and Adjacent to Kellogg Creek Watershed (Jones & Stokes Associates 1991f).

Because of the potential issues associated with relocating Vasco Road through occupied and suitable, unoccupied kit fox habitat, the San Joaquin kit fox has been the subject of substantial communication between CCWD, Reclamation, DFG, and USFWS. Extensive coordination, effort, and expense were undertaken to design the relocated Vasco Road to minimize possible impacts on the kit fox. Continuing input from both USFWS and DFG will be sought to ensure that impacts on special-status plant and animal species are avoided and minimized.

To fulfill its obligations in evaluating fisheries impacts, CCWD, in consultation with USFWS, NMFS, DFG, Reclamation, and DWR, developed methodologies for evaluating impacts, determining impact significance, and developing mitigation measures to reduce the severity of impacts.

In late 1990, CCWD published Los Vaqueros Operations Studies Methodology and Assumptions, a document that outlined the hydrologic modeling process to be used for EIR/ EIS analyses and the assumptions that would form the foundations for the analyses. This document was submitted for comment to USFWS, DFG, NMFS, DWR, and Reclamation.

In February 1991, CCWD submitted to the above agencies Preliminary Draft Fisheries and Study Results for Contra Costa Water District's Los Vaqueros Project Stage 2 EIR/EIS, a more detailed description of fisheries methodologies and preliminary fisheries impact assessment results. DFG fisheries biologists indicated that the information provided in the document was adequate and no comments were necessary. USFWS indicated that, although they would be unable to provide written comments, the methodologies appeared to have no serious flaws. NMFS, although generally satisfied with the methodologies, suggested that additional studies be included on fish screen design. This recommendation has been followed in this EIR/EIS.

Consultation with the above resource agencies will continue through construction and implementation of the project.

Endangered Species Act (16 USC 1531 et seq.)

Section 7 of the federal Endangered Species Act requires federal agencies, in consultation with the U.S. secretary of the interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies must request from USFWS (and, if appropriate, NMFS) information on the existence within a project area of species listed or proposed for listing.
- Following receipt of USFWS and NMFS responses to this request, agencies can prepare a biological assessment to determine whether any listed species or species proposed for listing are likely to be affected by a proposed action.
- Agencies must initiate formal consultation with USFWS and NMFS if the proposed action affects listed species.
- USFWS and NMFS must prepare a biological opinion to determine whether the action would jeopardize the continued existence of listed species or adversely modify their critical habitat.
- If a finding of jeopardy or adverse modifications is made in the biological opinion, the agency must modify its project to ensure that listed species are not jeopardized or their critical habitat adversely modified, unless an exemption from this requirement is granted.

On March 27, 1991, CCWD (as Reclamation's designated nonfederal representative), requested information from USFWS concerning listed and candidate species that could be affected by the preferred alternative being considered in the Los Vaqueros Project Stage 2 EIR/EIS. The USFWS delivered to CCWD a list of such species on May 7, 1991. These species are discussed in Chapters 4, 6, 7, and 8 of this document. CCWD also identified species of concern to NMFS through formal consultation.

The formal Section 7 consultation process with the USFWS Sacramento Endangered Species Office and NMFS for the project is scheduled to be initiated by Reclamation in February 1992. Formal consultation is scheduled to conclude in May 1992. A biological assessment for each of the pertinent species will be submitted by Reclamation and CCWD to USFWS and NMFS with biological opinions from the USFWS and NMFS expected shortly thereafter. The biological opinions from each of the agencies will be included in the final EIR/EIS.

Detailed information on CCWD and Reclamation's communications with USFWS and DFG is provided above under "Fish and Wildlife Coordination Act (16 USC 661 et seq.)".

National Historic Preservation Act (16 USC 470)

Section 106 of the National Historic Preservation Act requires federal agencies to take into consideration the effects of their undertakings on historical, archeological, and cultural resources. Federal agencies are required to identify historical and archeological properties near proposed projects, including properties on the NRHP and those that are eligible for listing in the NRHP. If the project is determined to have an adverse effect on NRHP-listed properties or those eligible for listing in the NRHP, the agency is required to consult with the State Historic Preservation Officer and the Advisory Council on Historic Preservation to develop alternatives or mitigation measures to reduce, avoid, or mitigate effects on historic properties.

Consultation for compliance with Section 106 has been initiated with the OHP. A programmatic memorandum of agreement (PMOA) is being prepared that outlines the steps and timing of Section 106 compliance for the project. Chapter 11, "Cultural Resources", describes the potential effects of project alternatives on cultural resources and identifies measures that may be necessary to avoid or reduce impacts on cultural resources. The Section 106 process has proceeded concurrently with the draft EIR/EIS and will continue through preparation of the final EIR/EIS.

Executive Order 11593 (Protection and Enhancement of the Cultural Environment, 1971)

This executive order outlines federal procedures for protecting cultural resources under federal ownership and provides direction on the process by which eligible properties are nominated for listing in the NRHP. Section 1(3) requires that, in planning projects and programs, federal agencies contribute to the preservation and enhancement of nonfederally owned sites, structures, and objects of historical, architectural, or archeological significance. This order also strengthened Section 106 by extending the requirements of the law to protect NRHP properties and properties potentially eligible for the NRHP. The 1980 amendments to the National Historic Preservation Act incorporated most of the requirements of Executive Order 11593.

American Indian Religious Freedom Act of 1978

This legislation sets forth the policy of the U.S. Department of the Interior to protect and preserve the observance of traditional Native American religions. The act requires federal agencies to evaluate their policies and procedures to ensure compliance with this policy.

Beginning in July 1991 (before any construction activities begin that could have project-related impacts on Native American resources), CCWD and Reclamation contacted local tribal representatives for input regarding the treatment of Native American cultural resources that may be affected by project construction and operation. The discussions between CCWD, Reclamation, and Native American representatives revolved around the reinternment of Native American remains found during the period from testing through mitigation, the handling of associated artifacts, and Native American access rights to sacred sites on CCWD landholdings.

In addition to the requirements and processes listed above, CCWD, in cooperation with EBRPD, is committed to purchase the Vasco Caves area. The area would be purchased and managed to protect the caves for sacred use by Native Americans. Consultation with Native American groups will be undertaken to determine how best to provide limited access rights to the Vasco Caves area.

Farmlands Protection Policy

Memoranda from the U.S. Council on Environmental Quality to heads of agencies dated August 30, 1976, and August 11, 1980, and the Farmlands Protection Policy Act of 1981 require agencies in their EISs to include farmlands assessments designed to minimize adverse impacts on prime and unique farmlands. As described in Chapter 10, "Geology, Seismicity, and Soils", the Los Vaqueros Reservoir, Kellogg Reservoir, and Middle River Intake/EBMUD Emergency Supply Alternatives would cause only minor permanent losses of farmland acreage in areas in eastern Contra Costa County outside the Kellogg Creek watershed. The Desalination/EBMUD Emergency Supply Alternative would result in the permanent loss of 99 acres of land designated as prime farmland. In the Kellogg Creek watershed, the Los Vaqueros Reservoir or Kellogg

Reservoir Alternatives would inundate approximately 1,500 acres of land now used for pasture and dryland farming. Because these lands are not considered prime or unique farmlands and the remainder of the watershed would be preserved for agricultural uses, these alternatives would not be inconsistent with federal policies regarding prime and unique farmlands.

The environmental analysis of the project alternatives includes a thorough discussion of impacts on prime and unique farmlands. The analysis includes an evaluation of farmlands using CDC and SCS classifications and an evaluation of the project's effects on prime and unique farmlands as determined by the CDC's Farmland Mapping and Monitoring Program.

Executive Order 11988 (Floodplain Management)

Executive Order 11988 requires federal agencies to prepare floodplain assessments for proposals located in or affecting floodplains. An agency proposing to conduct an action within a floodplain must consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the only practicable alternative involves siting in a floodplain, the agency must minimize potential harm to or development within the floodplain and explain why the action is proposed within the floodplain. Although located in a floodplain, the Los Vaqueros Reservoir and Kellogg Reservoir Alternatives would reduce the potential for flooding of Kellogg Creek downstream of the impoundment facilities, which would be a beneficial effect.

A detailed discussion of the project alternatives' effects on hydrology is provided in Chapter 3, "Delta System Hydrodynamics", and Chapter 6, "Kellogg Creek Water Resources and Public Safety". For information regarding the project alternatives' effects on public health and safety, see Chapter 6, "Kellogg Creek Water Resources and Public Safety".

According to FEMA maps, designated 100-year floodplains exist in several locations in the portion of the project area that could accommodate pipelines. Reclamation has prepared a floodplain assessment that indicates that pipelines and the spoils areas that would result from construction activities have been designed to avoid any alterations in floodflows.

Executive Order 11990 (Protection of the Wetlands)

Executive Order 11990 requires federal agencies to prepare wetlands assessments for proposals located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practicable alternative is available and the proposed action includes all practicable measures to minimize harm to wetlands.

The project alternatives would result in direct impacts on wetlands. All project alternatives were evaluated for their impact on wetlands and other resources and for their ability to meet project objectives.

The mitigation specified for the impacts of the Los Vaqueros Project on wetlands requires avoidance, replacement, and enhancement measures that would replace all wetland acreage and habitat values lost.

For a detailed discussion of the project alternatives' impacts on wetlands, see Chapter 7, "Vegetation Resources". Additional information on CCWD's and Reclamation's consultation and coordination efforts regarding wetlands is provided below.

Clean Water Act, Section 404

A Section 404 permit must be obtained from the Corps for the discharge of dredged or fill materials to waters of the United States, including adjacent wetlands. The Corps reviews applications for Section 404 permits in accordance with guidelines for Section 404 of the Clean Water Act, which have been established by EPA. The Corps must also determine that the project is not contrary to the public interest (33 CFR 323.6). Project activities covered by Section 404 include construction pipelines, the Los Vaqueros dam, impoundment of the reservoir waters, the intake site, and the relocation of Vasco Road.

A draft alternatives analysis was prepared and submitted to EPA and the Corps in partial compliance with 40 CFR 231.10(a) compliance in the Section 404(b)(1) guidelines. The Stage 2 EIR/EIS is being used to determine the environmental effects of the various alternatives. The information from this Stage 2 EIR/EIS will be used to complete the Section 404(b)(1) requirements and the Corps public interest review and to provide information to address EPA's Section 404(b)(1) guidelines (40 CFR 230.10[a], [b], and [d]).

Coastal Zone Management Act

The Coastal Zone Management Act (Coastal Act) was passed by the California Legislature in 1976 and went into effect on January 1, 1977. The Coastal Act established a framework for resolving conflicts between competing interests for limited coastal lands. The highest priority is placed on the preservation and protection of natural resources, including environmentally sensitive habitat areas (i.e., wetlands, dunes, and areas with special-status species). In the case of habitat areas, only uses dependent on these resources are allowed. For agricultural land, the intent of the Coastal Act is to keep the maximum amount of prime land in production.

The goals and policies of the Coastal Act are to be carried out by local government through a process of comprehensive and coordinated planning known as the Local Coastal Program (LCP). The LCP is defined in Section 30108.6 of the Coastal Act as the local government's land use plans and implementing actions, which, when taken together, meet the requirements of the act and implement its policies. Once the LCP is certified, the local government assumes full permit authority for development within the coastal zone.

Only one project alternative, the Desalination/EBMUD Emergency Supply Alternative, would fall within the California coastal zone. Construction and operation of outfall facilities in Suisun Bay would require permits from federal and state agencies, including the San Francisco Bay Conservation and Development Commission, which has jurisdiction over the coastal zone in the Bay Area. Other agencies that would have permitting responsibilities are the State Lands Commission, the Corps, and the Central Valley RWQCB.

Because the Desalination/EBMUD Emergency Supply Alternative is not the proposed project, only reconnaissance-level communications have been undertaken with the pertinent agencies on this issue.

Rivers and Harbors Act of 1899 (33 USC 401-413, Sec. 407)

Section 10 of the Rivers and Harbors Act of 1899 prohibits the unauthorized obstruction or alteration of any navigable waters of the United States. The construction of any structure in or over any navigable water; excavation or deposit of materials in such waters; and various types of work performed in such water, including fill and stream channelization, are examples of activities requiring a permit from the Corps.

CCWD has submitted a joint Section 10/Section 404 permit application to the Corps. CCWD and Reclamation have had ongoing discussions with Corps representatives since late 1989, primarily related to CCWD's Section 404 permit application. Many of the activities carried on in these discussions, although specifically applicable to Section 404 requirements, will also satisfy requirements under Section 10 of the Rivers and Harbors Act.

AGENCIES AND INDIVIDUALS RECEIVING COPIES OF THE STAGE 2 EIR/EIS

To Be Distributed by the Deputy Commissioner's Office, Bureau of Reclamation, for Review and Comment

U.S. Department of the Interior

Bureau of Land Managment
Fish and Wildlife Service
Geological Survey

Other Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army
Department of Commerce
Department of Energy
Environmental Protection Agency
Pacific Fishery Management Council

To Be Distributed by the Deputy Commissioner's Office, Bureau of Reclamation, for Information Only

United States Senate, Washington DC

Honorable Alan Cranston
Honorable Paul Seymore

United States House of Representatives, Washington DC

Honorable Vic Fazio
Honorable George Miller
Honorable Pete Stark

To Be Distributed by the Regional Director, Mid-Pacific Region, for Review and Comment

U.S. Department of the Interior

Bureau of Indian Affairs, Sacramento
Bureau of Land Management, Sacramento
Fish and Wildlife Service, Portland; Sacramento (2)
National Park Service (2)
Regional Environmental Office, San Francisco

Other Federal Agencies

Army Corps of Engineers, Sacramento
Environmental Protection Agency, San Francisco
National Marine Fisheries Service, Terminal Island
Western Area Power Administration, Sacramento

California State Senate

Honorable Dan Boatwright
Honorable Bill Lockyer
Honorable Nick Petric

California State Assembly

Honorable William Baker
Honorable Robert Campbell
Honorable Phil Isenberg

California State Agencies

Air Resources Board
Bay Area Air Quality Management District
Central Valley Regional Water Quality Control Board
Department of Boating and Waterways
Department of Conservation
Department of Fish and Game
Department of Water Resources
Native American Heritage Commission
Office of Historic Preservation
Public Utilities Commission
Reclamation Board
San Francisco Bay Conservation and Development Commission
San Francisco Regional Water Quality Control Board
State Clearing House
State Lands Commission
State Water Resources Control Board

Local Government

Alameda County
Alameda County Resource Conservation District
Ambrose Recreation and Park District
Byron-Bethany Irrigation District
City of Antioch
City of Brentwood
City of Livermore
City of Oakley
City of Pittsburg
City of Walnut Creek
Contra Costa County
Contra Costa Local Agency Formation Commission
Contra Costa Transportation Authority
Delta Diablo Sanitation District
East Contra Costa Irrigation District
Santa Clara Valley Water District

State and Public Libraries

California State Library
Contra Costa County (4 locations)

Interested Groups

American Fisheries Society
American River Association
American Water Resources Association
Byron Chamber of Commerce
California Native Plant Society
Chevron Pipeline Company
Citizens for a Better Environment
Citizens to Improve the Delta
Concerned Citizens for Improved Water Quality
Contra Costa Historical Society
Defenders of Wildlife
Discovery Bay Homeowners
Ducks Unlimited
East Bay Municipal Utility District
East Bay Regional Park District
Environmental Defense Fund
Funds for Animals, Inc.
Greenbelt Alliance
Mathew G. Coelho & Sons, Inc.
Mt. Diablo Audubon Society
National Audubon Society
National Water Resources Association
National Wildlife Federation
National Resources Defense Council
Pacific Gas and Electric Company
Sierra Club, Diablo Chapter
Sierra Club, San Francisco

Sierra Club Transportation Committee
Texaco Trading and Transportation
The Nature Conservancy
Trout Unlimited
West Pittsburg Alliance
Wildlife Society

Individuals

Wilhelmina Andrade
Mark Armstrong
Darrell Bolognesi
Glenn Coppe
Michael Crosetti
Sharon Donithan
Jim Eisen
George Harmtmann
Ralph Hernandez
Nick LaSorella
Frank Lehmkohl
Holly Miller
Darryl Mueller
John Nejedly
Ron Nunn
William Popp
Mark Purdom
James Robinson
John Roebuck
Sal Sangimino
Anthony Souza
Steve Thomas
Hugh Walker
John Wang
Jack Williams

Chapter 21. Citations

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PERSONAL COMMUNICATIONS

Ania, Tony. Acting director of finance. Contra Costa County, Martinez, CA. April 8, 1991 - telephone conversation regarding county fiscal situation.

Annunciacion, Edgar. Electrical engineer. Western Area Power Administration, Sacramento, CA. May 5, 1991 - telephone conversation regarding WAPA's ability to supply energy to the proposed project.

Arata, Jack. Farmer. Brentwood, CA. April 27, 1989 - letter.

Arntzen, Karen. Public information representative. Contra Costa Water District, Concord, CA. June 20, 1991 - memorandum regarding customer complaints, data compiled by John August.

Bainbridge, Susan. Research assistant. Natural Diversity Data Base, California Department of Fish and Game, Sacramento, CA. January 28, 1991 - telephone conversation.

Balanda, Bonnie. Administrative clerk. East Bay Regional Park District, Lake Del Valle, Martinez, CA. May 21, 1991 - telephone conversation.

Bartel, Jim. Botanist/Section 10 coordinator. U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA. January 1987 to December 1988 - meetings.

Beard, Clyde. Planner. Contra Costa County Community Development Department, Martinez, CA. May 22, 1991 - telephone conversation.

Beeman, Gary A. Wildlife biologist. Private consultant, Lafayette, CA. May 10, May 15, and June 5, 1991 - telephone conversations; May 16, 1991 - meeting.

Berg, Ken. Botanist. California Native Plant Society, Sacramento, CA. August 24, 1988 - telephone conversation.

Bittman, R. Botanist. California Department of Fish and Game, Sacramento, CA. March 26, June 2, and August 24, 1988 - telephone conversations.

Blackmer, William. Project technical manager. Los Vaqueros Project. Concord, CA. December 17, 1990 - memorandum to John S. Gregg concerning desalination plant alternative; January 17, 1991 - memorandum regarding Task 31 - Kellogg Creek downstream channel improvements; January 22, 1991 - memorandum to John S. Gregg concerning construction planning.

Bolt, Dennis. Executive vice president. Regional Medical Systems, Fremont, CA. May 15, 1991 - facsimile regarding service.

Brewer, Donna. Biologist. U.S. Fish and Wildlife Service, Ventura, CA. July 1, 1991 - telephone conversation.

Brode, John. Fisheries biologist. California Department of Fish and Game, Rancho Cordova, CA. November 15, 1989 - telephone conversation; July 30, 1991 - meeting.

Brody, Kenneth A. Project manager. Hodges & Shutt, Santa Rosa, CA. January 9, 1992 - telephone conversation.

Brokaw, Elisabeth. Planning analyst. Pacific Gas and Electric Company, San Francisco, CA. May 6, 1991 - facsimile transmittal regarding PG&E peak demand periods.

Brouwer, Carl. Engineer. James M. Montgomery, Consulting Engineers, Walnut Creek, CA. September 7, 1989 - memorandum.

Carniglia, Victor. Deputy director. City of Antioch, Developmental Services, Antioch, CA. June 14, 1991 - telephone conversation.

Chee, Larry. Coordinator, fish agreement. California Department of Water Resources, Sacramento, CA. August 1991 - memorandum of Two Agency Fish Agreement and revised survival rates.

Chu, James. Engineer. Alameda County Department of Public Works, Hayward, CA. April 18, 1991 - telephone conversation.

Cockrell, Seth. Operations manager. Western Water Ways, Inc., Brentwood, CA. April 22, 1991 - telephone conversation regarding The Cruiser Haven.

Conna, T. S. Coordinator. Urban Forest Task Force, Contra Costa County Planning Department, Martinez, CA. January 20, March 6, and July 21, 1991 - telephone conversations.

Cortez, Teresa. Park ranger. California Department of Parks and Recreation, Mt. Diablo State Park, Walnut Creek, CA. April 15, 1991 - telephone conversation regarding Mt. Diablo use.

Cox, Terrence. Watershed manager. Contra Costa Water District, Los Vaqueros Project, Concord, CA. October 12, 1990 - meeting; March 29, 1991 - telephone conversation; April 2, 1991 - facsimile transmittal regarding wind study progress summary; May 17, 1991 - telephone conversation regarding compensation to fire districts.

Cutler, Jim. Planner. Contra Costa Community Development Department, Concord, CA. April 25, 1991 - telephone conversation regarding planned residential growth in east county region.

Dele Cruz, Louis. Park supervisor. East Bay Regional Park District, Lake Del Valle, Martinez, CA. May 21, 1991 - telephone conversation.

Ducey, Ron. Nimbus Fish Hatchery manager. California Department of Fish and Game, Rancho Cordova, CA. September 24, 1987, and October 5, 1988 - telephone conversations.

Dyer, Norm. Senior planner. McGill, Martin, and Self, Orinda, CA. May 7, 1991 - telephone conversation.

Edwards, Stephen W. Director. Tilden Regional Parks Botanical Garden. Berkeley, CA. January 23, 1991 - telephone conversation.

Elliff, John. Battalion chief. California Department of Forestry and Fire Protection, Brentwood, CA. April 25, 1991 - telephone conversation.

Emerson, Stan. Emerson Dairy, Oakley, CA. June 19, 1991 - letter.

Erba, Gene. Program analyst. California Department of Parks and Recreation, Sacramento, CA. April 15, 1991 - telephone conversation regarding use data.

Fisher, Frank. Fisheries biologist. California Department of Fish and Game, Red Bluff, CA. August 9, 1989 - telephone conversation.

Goetz, Steve. Transportation planner. Contra Costa County Community Development Department, Transportation Planning Division, Martinez, CA. July 27 and September 22, 1989 - letters.

Greenwood, Greg. Botanist. California Department of Forestry and Fire Protection, Forest and Rangeland Resources Assessment Program, Sacramento, CA. January 31 and April 23, 1991 - telephone conversations.

Hansen, George. Consulting herpetologist. Independent consultant, Sacramento, CA. January 18, January 25, and July 15, 1988 - telephone conversations.

Hartefgeldt, Dave. Project manager. H. T. Harvey & Associates, Fresno, CA. February 25, 1991 - telephone conversation.

Hayes, John. Fisheries management supervisor. California Department of Fish and Game, Redding, CA. August 4, 1988 - telephone conversation.

Hein, Paul. Fire chief. East Diablo Fire Protection District, Brentwood, CA. May 8, 1991 -letter regarding service.

Henderson, Gloria. Engineer. James M. Montgomery, Consulting Engineers, Inc., Walnut Creek, CA. March 26, 1991 - telephone conversation regarding energy consumption for operation of existing and future-year no-action alternatives.

Hess, Bryan. Curator. Pacific Union Herbarium, Angwin, CA. January 23, 1991 - telephone conversation.

Hicks, Mike. Project engineer. Los Vaqueros Project, Concord, CA. May 31, 1991 - telephone conversation regarding project operations employment estimates and residences or businesses displaced under nonreservoir alternatives.

Hoffmann, Sarah. Planner. Contra Costa County Community Development Department, Martinez, CA. May 17, 1991 - telephone conversation.

Holz, Pat. Assistant to the Secretary Treasurer Greg Feer. Building and Construction Trades Council, Concord, CA. March 14, 18, and 21, 1991 - telephone conversations and facsimile regarding available construction labor pool.

Kanim, Nadina. Biologist. Endangered Species Office, Sacramento, CA. August 28, 1990 -meeting; September 27, 1990 - telephone conversation.

Kent, Jerry. Operations manager. East Bay Regional Park District, Oakland, CA. October 1, 1990 - memorandum.

King, Ed. Permit engineer. Contra Costa County Department of Public Works, Martinez, CA. April 18, 1991 - telephone conversation.

Leary, Neal. Engineer. Contra Costa County Department of Public Works, Martinez, CA. April 18, 1991 - telephone conversation.

Lee, Sharon. Administrative secretary. Valley Memorial Hospital, Livermore, CA. April 23, 1991 - telephone conversation.

Lobese, Bob. Marketing representative. Waste Fibre Recovery, Brentwood, CA. April 26, 1991 - telephone conversation.

Lopez, Albert. Planner. City of Livermore Planning Department, Livermore, CA. March 19, 1991 - telephone conversation.

Martin, Roger. Senior project manager. Ionics, Inc., Santa Barbara, CA. July 8, 1991 - telephone conversation.

McGinnis, Sam. Professor. California State University, Hayward, CA. June 1988 to September 1991 - telephone conversations; May 18, 1989 - meeting; November 26, 1991 - meeting.

Mitchell, Mark. Sales manager. Coast Oil Company, San Jose, CA. May 1, 1991 - telephone conversation regarding effect of diesel fuel consumed during project construction on local diesel fuel resources.

Morgan, Randy. Botanist. Alameda, CA. January 23, 1991 - telephone conversation.

Muick, Pam. Botanist. University of California, Berkeley, Forestry Department, Berkeley, CA. May 29, 1991 - telephone conversation.

Nicholson, Charles. Supervising environmental health specialist. Contra Costa County Health Department, Martinez, CA. April 15, 1991 - telephone conversation.

Olsen, Brad. Botanist. California Native Plant Society, East Bay Chapter, Berkeley, CA. April 22, 1991 - telephone conversation.

Padilla, Ed. Senior registered environmental specialist. San Joaquin County Health Department, Stockton, CA. April 29, 1991 - telephone conversation.

Palmisano, Terry. Wildlife biologist. California Department of Fish and Game, Region 3, Yountville, CA. October 5, 1989 - meeting.

Papadakos. Chief. Byron Fire District, Byron, CA. May 17, 1991 - telephone conversation regarding Byron Fire District's operating budget.

Parreira, Chris. Assistant supervisor, Skinner Fish Protection Facilities. Department of Water Resources, Delta Field Division, Byron, CA. June 17, 1991 - telephone conversation.

Pavlick, Bruce. Professor. Sonoma State University, Sonoma, CA. October 12, 1990 - telephone conversation.

Pope, Tom. Sales manager. Raisch Company, San Jose, CA. May 17, 1991 - telephone conversation.

Preston, Robert N. Traffic engineer. Alameda County Public Works Agency, Hayward, CA. November 8, 1989 - letter.

Probert, Rick. Assistant chief. San Ramon Valley Fire District, San Ramon, CA. December 31, 1991 - telephone conversation.

Raiche, Roger. Horticulturalist. University of California, Berkeley Botanical Garden, Berkeley, CA. January 31, 1991 - telephone conversation.

Regis, Andy. Vice President of Geology and Environmental Affairs. Unimin Corporation, New Canaan, CT. August 22, 1989 - meeting.

Ritchie, Kirsten. Director of Environmental Affairs. Browning-Ferris Industries, Livermore, CA. August 25 and October 5 and 9, 1989 - telephone conversations.

Robinette, Gorgie. Horticulturist. Robinette Bulb Farm, Sebastipol, CA. January 23, 1991 - telephone conversation.

Robinson, James. Petitioner. Livermore, CA. April 1989 - letter.

Roderick, Wayne. Retired director. Tilden Botanical Garden, Berkeley, CA. February 4, 1991 - telephone conversation.

Romero, Bobby. Auditor. Contra Costa County, Auditors Office, Martinez, CA. May 22, 1991 - telephone conversation regarding fire district revenue sources.

Rubini, Joe. Fire chief. East Bay Regional Park District, Martinez, CA. April 15, 1991 - telephone conversation.

Ryan, Sandra. Director of public relations. John Muir Medical Center, Walnut Creek, CA. March 25, 1991 - telephone conversation.

Sabet, Morteza. Director of systems planning and engineering. Western Area Power Administration, Sacramento, CA. April 2, 1991 - telephone conversation regarding relationship between WAPA, PG&E, and CCWD.

Sandberg, Lars. Los Vaqueros Project property manager. Contra Costa Water District, Concord, CA. April 30, 1991 - telephone conversation regarding energy/cost modeling for Los Vaqueros Project; May 31 and July 3, 1991 - facsimiles.

Santana, Donald. Professor of botany. Gavillan College, Department of Natural Sciences, Gilroy, CA. January 4, 1991 - telephone conversation.

Sarna, Pete. Director of public safety. East Bay Regional Parks District, Concord, CA. April 12, 1991 - telephone conversation.

Schmoldt, Don. Biologist. LSA Associates, Inc., Pt. Richmond, CA. November 11, 1990 -telephone conversation; December 3, 1990 - telephone conversation.

Shakerin, Nazanin. Transportation engineer. TJKM Transportation Consultants, Pleasanton, CA. July 28, 1989 - memorandum.

Sherock, Robert. Sergeant. Contra Costa County, Sheriff/Coroner's Office, Martinez, CA. May 17, 1991 - telephone conversation regarding contracting for police protection; April 22 and 25, 1991 - telephone conversations.

Shieh, Clif. Project coordinator. Contra Costa Water District, Concord, CA. April 30, 1991 - telephone conversation regarding the number of wind turbines removed by the updated county line alignment.

Shinmoto, Brian. Technician. U.S. Bureau of Reclamation, Stockton, CA. August 18, 1988 - telephone conversation.

Simons, Laurie. Biologist. U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA. December 1990 to September 1991 - telephone conversations; January 15 and April 23 and 30, 1991 - meetings.

Smith, Jim. Project leader. U.S. Fish and Wildlife Service, Red Bluff, CA. June 2 and August 8, 1989 - telephone conversations.

Stevens, Don. Fisheries biologist. California Department of Fish and Game, Stockton, CA. February 2, 1990 - meeting; May 10, 1991 - telephone conversation.

Stromberg, Larry. Private consultant. Richmond, CA. May 15, 1990 - telephone conversation.

Taylor, Dean. Botanist. BioSystems Analysis, Inc., Santa Cruz, CA. January 15, 1991 - telephone conversation.

Townsend, Heather. Research assistant. Natural Diversity Data Base, California Department of Fish and Game, Sacramento, CA. February 27, 1991 - telephone conversation.

Uy, Fil. Traffic engineering technician. Contra Costa County Public Works, Martinez, CA. March 18, 1991 - telephone conversation.

Velmen, Don. Lieutenant. California Highway Patrol, Dublin, CA. April 26, 1991 - telephone conversation.

Vukad, Leroy. Assistant traffic engineer. Contra Costa County Public Works, Martinez, CA. March 15, 1991 - telephone conversation.

Wagstaff, Lloyd. Land acquisition manager. East Bay Regional Park District, Oakland, CA. April 11, 1991 - telephone conversation regarding acquisition of CCWD lands.

Ward, Robert F. Vasco Road resident. Livermore, CA. May 2, 1989 - letter.

Wernette, Frank. Biologist. California Department of Fish and Game, Bay-Delta Fisheries Unit, Stockton, CA. May 23 and 25, 1988, and November 6, 1989 - telephone conversations; March 7, 1989 - meeting.

Whan, Eric. Engineering staff member. Contra Costa County Public Works Department, Road Engineering Division, Martinez, CA. July 17, 1989 - letter.

Whelan, Judy. Assistant director of finance. Contra Costa Water District, Concord, CA. August 19, 1991 - telephone conversation; August 23, 1991 - facsimile of raw water average 1991 bill calculation.

White, Wayne S. Field supervisor. U.S. Fish and Wildlife Service, Sacramento, CA. December 27, 1990 - letter.

Wilcox, Carl. Environmental services. California Department of Fish and Game, Yountville, CA. August 28, 1990 and January 15, 1991 - meetings; January 1990 to September 1991 - telephone conversations.

Williams, Kevin. Senior environmental health specialist. Stanislaus County Department of Environmental Resources, Modesto, CA. April 29, 1991 - telephone conversation.

Wilson, Greg. Dispatcher. Woolsey Oil, Stockton, CA. May 1, 1991 - telephone conversation regarding effect of diesel fuel consumed during project construction upon local diesel fuel resources.

Yeung, Manho. Senior engineer. Pacific Gas and Electric Company, San Francisco, CA. April 25, 1991 - telephone conversation regarding energy capacity and demand information for 1990 and 2009 and amount of project energy use that would be considered a problem for PG&E.

Chapter 22. List of Preparers

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David Leib	M.S., Civil Engineering and Applied Mathematics, P.E.; 6 years' related experience	Water quality modeling
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Doug Brewer	B.S., Wildlife Biology; 9 years' related experience	Delta systems water quality section
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Chapter 23. Index

Appendix A. Preliminary Fish Screen Design for Supplemental Intake Facilities

Los Vaqueros Reservoir Alternative - Fish Screens at the Delta Intake

The Los Vaqueros Project would include construction of a new intake located at one of several points along Old River or in Clifton Court Forebay in the Sacramento-San Joaquin Delta. The maximum deversion at the new intake would be 250 cubic feet per second. The new intake would be screened. The screen design would be similar for all intakes (Figure 1), although the depth of the intake would depend on the channel depth at the intake location.

The screen material would be wedge wire with 3/32-inch spacing of the screen slots. The maximum approach velocity to the screens would be 0.33 feet per second. The flow past the screens would provide passive cleaning of the screens (except for the Clifton Court intake). Passive cleaning would be supplemented with a screen cleaner. The screen cleaner would be a modified trash rack cleaner fitted with brush that would move from the bottom to the top of the screen panels. Debris would be deposited onto a conveyor that would move the material to a truck for removing or return the material back to the channel.

OLD RIVER SINGLE SOURCE

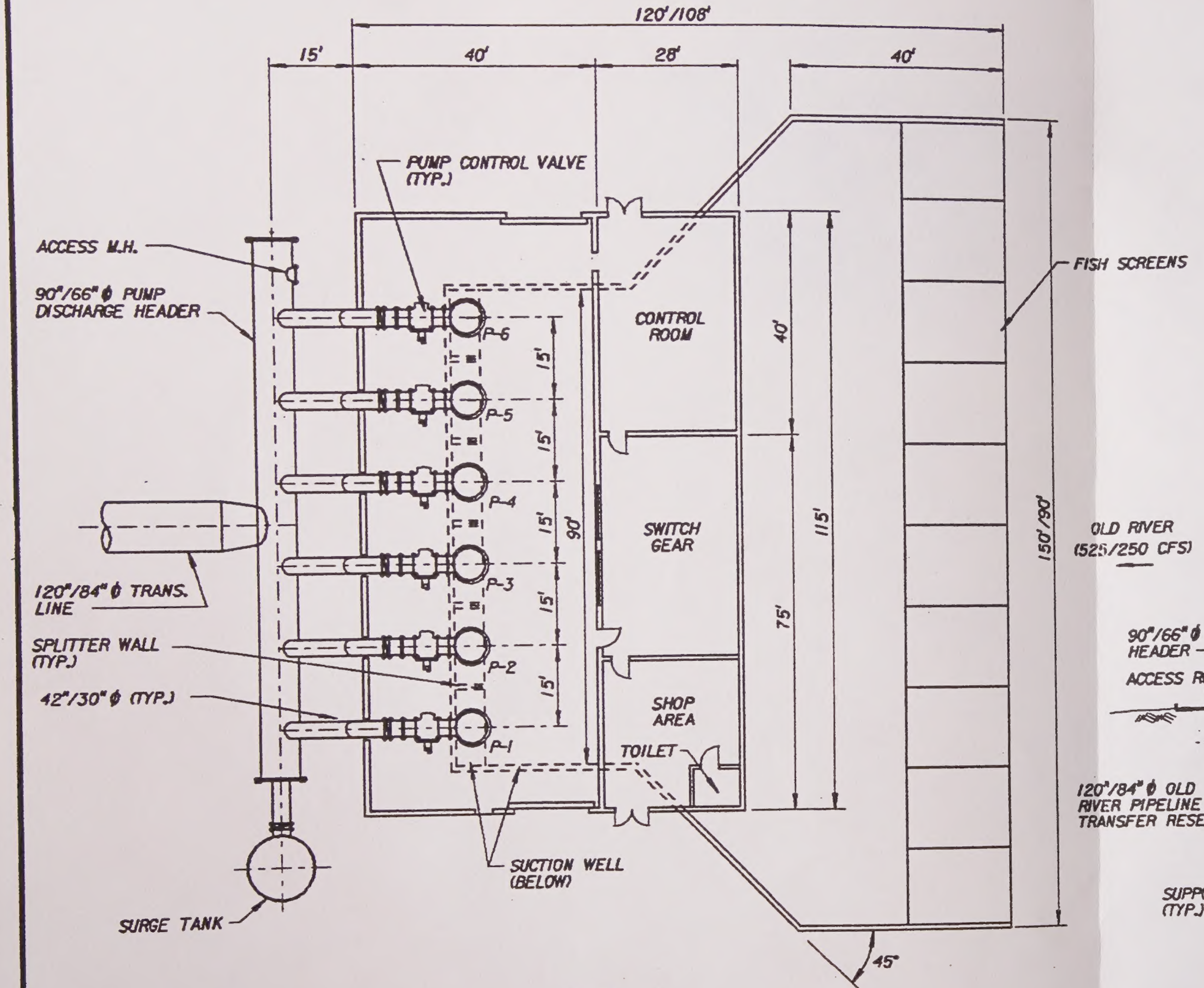
PUMPING PLANT CAPACITY = 525 CFS		
PUMPS	CAP./EA	TOT. CAP.
6	87 CFS	525 CFS

OLD RIVER WITH ROCK SLOUGH

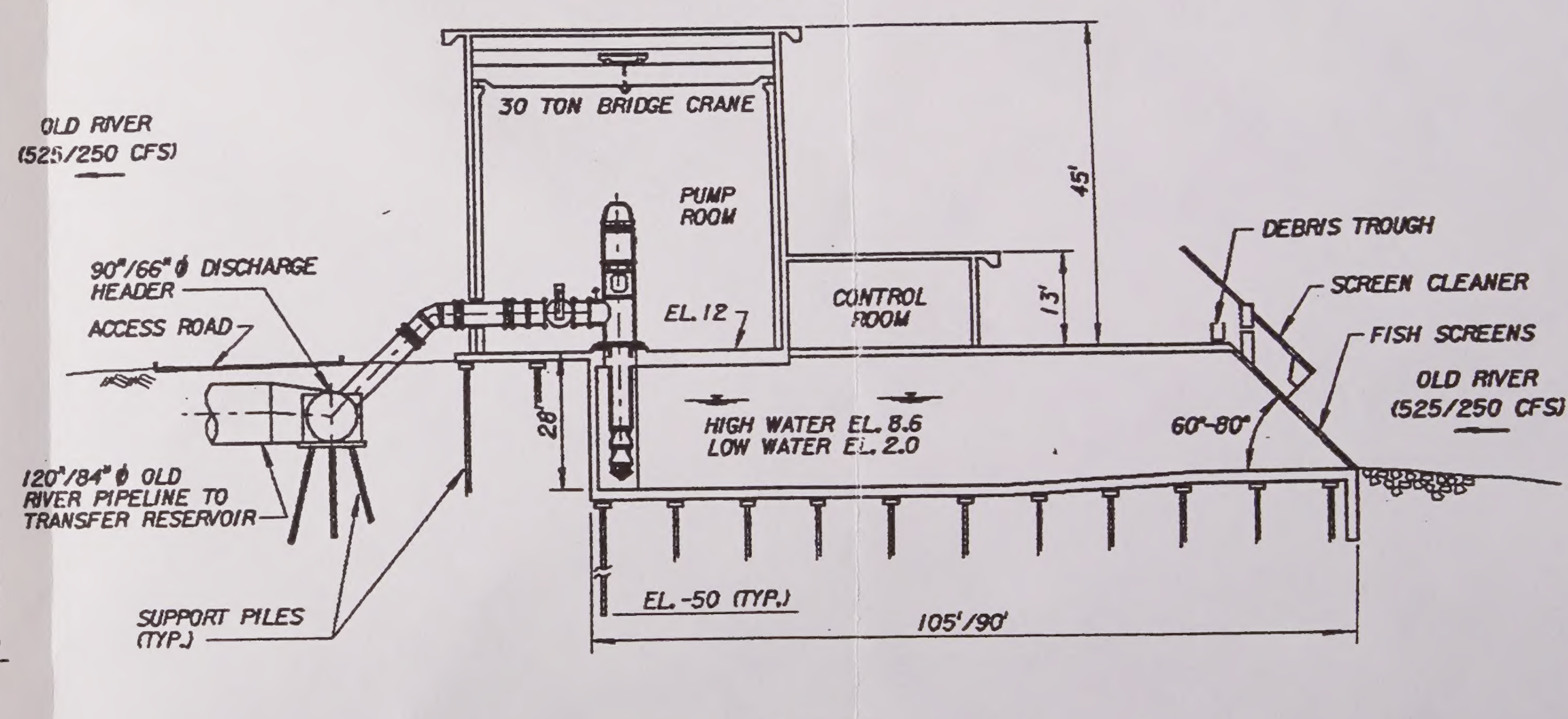
PUMPING PLANT CAPACITY = 250 CFS		
PUMPS	CAP./EA	TOT. CAP.
6	42 CFS	250 CFS

NOTE:

1. PUMPING PLANT LAYOUT SHOWN IS FOR TWO ALTERNATE CAPACITIES - 525 AND 250 CFS. DIMENSIONS SHOWN AS 150'/90' INDICATE SIZE VARIATIONS RELATED TO THE DIFFERENT CAPACITIES.
2. SEE ECONOMIC ANALYSIS IN APPENDICES E AND F FOR HORSEPOWER REQUIREMENTS.



PLAN



SECTION

FIGURE 17

OLD RIVER INTAKE FACILITIES

PLAN AND SECTION